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Report of the

FAO/GOVERNMENT OF AUSTRALIA EXPERT CONSULTATION ON GOOD MANAGEMENT PRACTICES AND GOOD LEGAL AND INSTITUTIONAL ARRANGEMENTS FOR SUSTAINABLE SHRIMP CULTURE

Brisbane, Australia, 4-7 December 2000

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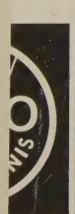

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DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY
AUSTRALIA
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS DOCUMENT

This is the final version of the report of the FAO/Government of Australia Expert Consultation on Good Management Practices and Good Legal and Institutional Arrangements for Sustainable Shrimp Culture, held at Queensland Department of Primary Industries, Brisbane, Australia, 4 to 7 December 2000, in cooperation with the World Bank, the Network of Aquaculture Centres in Asia-Pacific and the World Wide Fund for Nature.

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During the December 1997 FAO Technical Consultation on Policies for Sustainable Shrimp Culture, it was noted that the achievement of sustainable shrimp culture is dependent on effective government policy and regulatory actions, as well as the co-operation of the shrimp farming sector in utilizing sound technology in its planning, development and operations. In this regard, the Bangkok Consultation recommended that FAO convene expert meetings to elaborate best[1] practices for shrimp culture and desirable elements of the legal and other regulatory instruments for coastal aquaculture. Since then FAO, in collaboration with many agencies, pursued several initiatives in support of shrimp culture sustainability. As a follow up to the recommendations from the Bangkok Consultation, an Expert Consultation was convened by FAO and the Government of Australia on the 4 to 7 December 2000, in Brisbane, Australia. The main objectives of the Brisbane Expert Consultation were to provide a recognized international forum for discussion on major aspects related to the promotion of sustainable shrimp culture practices as well as of related institutional and legal instruments and to identify/determine avenues, as well as specific benefits and limitations, for the development and implementation of Good Management Practices and Good Legal and Institutional Arrangements leading to improvements in shrimp culture management practices at farm and institutional levels. The Brisbane Consultation was attended by 71 participants from 19 countries, including major shrimp producing and consuming nations. The participants included representatives from governments and non-government organizations, shrimp producers and associations and intergovernmental agencies. During the Brisbane Consultation, working papers prepared by FAO were discussed and further developed by participants. The Consultation developed and adopted a set of "Operating Principles" for sustainable shrimp culture and a set of recommendations including a follow-up process. Among others, the Brisbane Consultation recommended that a document on the objectives and operating principles, and the legal and institutional arrangements to support implementation, be prepared for presentation to an intergovernmental forum for formal agreement. The Brisbane Consultation requested FAO to facilitate this process. This document provides a detailed description of the preparation, conduct, and recommended follow-up of the Brisbane Consultation.

[1] The Report of the Bangkok FAO Technical Consultation refers to "best practices". The term "Good Management Practice"(GMP) was adopted by FAO for this Expert Consultation.

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INTRODUCTION

1. In December 1997, FAO convened the Technical Consultation on Policies for Sustainable Shrimp Culture which brought together government delegates and observers from 12 countries of Asia and the Americas accounting for about 90% of the global production of cultured shrimp and including major consuming countries. Observers from 5 inter-governmental organizations and from 4 international NGOs also attended. The Consultation noted that the achievement of sustainable shrimp culture is dependent on effective government policy and regulatory actions, as well as the co-operation of the shrimp farming sector in utilizing sound technology in its planning, development and operations. In this regard, the Consultation recommended that FAO convene expert meetings to elaborate best[1] practices for shrimp culture and desirable elements of the legal and other regulatory instruments for coastal aquaculture.

2. The Network for Aquaculture Centres for Asia and the Pacific (NACA), in partnership with the World Bank (WB), Worldwide Fund for Nature (WWF) and FAO are implementing a Consortium Programme on Shrimp Farming and the Environment. A central objective of the consortium is to identify better management practices for shrimp farming under various environmental, economic and social conditions and assess the cost-benefits for farmers to adopt these practices individually and in co-ordination with other farmers. This information is expected to help governments and the private sector to develop support strategies and specific assistance measures for farmers to overcome the constraints that currently prevent them to adopt better management practices. These strategies may encompass the adoption of codes of practices, improved extension services, economic incentives, and others. The Consortium Programme is undertaken primarily through a series of case studies covering all major producing regions of cultured shrimp.

3. Shrimp farming guidelines and codes of practices have been developed, or are under development, in a number of countries (e.g. Australia, Belize, Ecuador, India, Malaysia, Sri Lanka and Thailand). At international levels, a code has also been elaborated by an industry organization, the Global Aquaculture Alliance (GAA), that is intended to provide the basis for a future eco-labelling programme. Guidelines are also under development for the production of organically grown shrimp.

4. One area of special concern is the management of shrimp disease. FAO has been active in providing assistance to several member countries on health management in shrimp culture and has taken the lead in conducting the review on management strategies for major diseases in shrimp farming, one of the thematic reviews under the Consortium Programme. A number of programmes in co-operation with several agencies and organizations, with the view to develop Good Management Practices (GMPs) on shrimp health management, are being currently conducted by FAO in both Asia and Americas.

5. The Legal Office of FAO is currently working on a comparative survey of national laws and regulations governing shrimp culture. The purpose of the survey is to examine and compare relevant national legislation, particularly legal requirements concerning the environmental impacts of shrimp culture activities and measures applicable in relation to the development of shrimp farming installations, continuing operational controls, and legal requirements which apply on the cessation of activities and aspects related to enforcement of relevant legislation. This information is expected to help in the identification of good legal and institutional arrangements and in an assessment of current constraints for countries to adopt them.

OBJECTIVES AND OUTPUTS

6. As a follow up to the recommendations from the Bangkok Consultation and in support of the above activities, an Expert Consultation was convened by FAO and the Government of Australia on the 4 to 7 December 2000 (See Annex H – Prospectus of the Consultation for further details). The objectives of the Expert Consultation were to:

7. Provide a recognized international forum for discussion on major aspects related to the promotion of sustainable shrimp culture practices as well as of related institutional and legal instruments.

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[1] The Report of the Bangkok FAO Technical Consultation refers to "best practices". The term "Good Management Practice" (GMP) was adopted by FAO for this Expert Consultation.

8. Continue facilitating the process of consensus-building among major stakeholders concerned with shrimp culture development and management.

9. Identify/determine avenues, as well as specific benefits and limitations, for the development and implementation of Good Management Practices and Good Legal and Institutional Arrangements leading to improvements in shrimp culture management practices at farm and institutional levels.

The Expert Consultation was expected to produce the following outputs:

10. A set of 'generic' farm-level GMPs which are widely applicable in shrimp culture throughout the world.

11. Guidelines for the development and implementation of situation-specific GMPs at the national or sub-national level; these guidelines would relate to, inter alia, the identification of situation-specific issues, the methodology for cost-benefit analysis of GMPs; stakeholder participation; and others.

12. Constraint analysis for the adoption of GMPs and how to overcome them, including strategies to support farmers and farmer organizations in implementing better management practices.

13. A set of 'generic' good legal and institutional arrangements (GLIAs) that are widely applicable in shrimp culture throughout the world.

14. Guidelines for the development and implementation of country-specific GLIAs that take into account a country's specific legal and institutional conditions.

15. Constraints analysis for the adoption of GLIAs and how to overcome them, including strategies to support implementation of good institutional and legal arrangements.

The Agenda for the Expert Consultation is provided in Annex A.

16. Three working papers were prepared by FAO for the Consultation: (i) a Working paper on Operating Principles for Sustainable Shrimp Culture; (ii) a Working paper on Draft Guidelines for the development and Implementation of Situation-specific GMPs at the National or Sub-national level; and (iii) a Working Paper on Good Legal and Institutional Arrangements for Shrimp Culture. These working papers served as reference documents for Consultation working groups, and were subsequently discussed and further developed by participants during each Working Group session. Additional documents were submitted by delegates. The list of documents made available to the Expert Consultation is given in Annex G.

17. One of the expected outputs of the Expert Consultation was a set of 'generic" farm level GMPs which are widely applicable throughout the world. However, during the course of preparation and the conduct of the Consultation, the participants felt that the term "Operating Principles" for sustainable shrimp culture was preferred, because GMPs carried with them the connotation of precisely defined farm level practices. GMPs would always be highly specific to a particular environment, location and farming system. Thus, as a generic term, "Operating Principles" appeared to be a more adequate term.

PARTICIPATION

18. The Expert Consultation was attended by 73 participants from 18 countries, including major shrimp producing and consuming nations. The participants included representatives from governments, the private sector, non-government organizations and regional and international agencies. The list of participants is provided in Annex B.

OPENING CEREMONY

Chair: Jim Gillespie

19. The opening ceremony included welcome addresses by representatives of FAO (Dr. Rohana P. Subasinghe), NACA (Mr Pedro Bueno) and WWF (Dr. Jason Clay) and a keynote address by Dr. Warren Hoey, Director General of the Queensland Department of Primary Industries.

20. Following these welcome and keynote addresses, Dr Subasinghe introduced the purpose, scope and organization of the Expert Consultation.

SESSION I: TOWARDS IDENTIFYING GOOD MANAGEMENT PRACTICES AND GOOD LEGAL AND INSTITUTIONAL ARRANGEMENTS FOR SUSTAINABLE SHRIMP CULTURE: EXPERIENCES AND LESSONS

Chair: Jim Gillespie
Co-chair: Porfirio Alvarez Torres
Rapporteurs: Colin Shelley and Melba B. Reantaso

Presentation of thematic reviews and case studies

21. The session presented some experiences in shrimp culture management arising from the Consortium Programme on Shrimp Farming and the Environment. Summaries of the presentations and main discussion points are given in Annex J.

22. List of presentations are given below.

- The WB/NACA/WWF/FAO consortium programme on shrimp farming and the environment and other experiences: lessons learned – M.J. Phillips, J.W. Clay, R. Zweig and R.P. Subasinghe.
- Thematic review on coastal wetland habitats and shrimp culture – D. Macintosh, M.J. Phillips[2], B. Clough and R. Lewis.
- The shrimp culture industry better practices for addressing poverty and social equity issues - J. W. Clay.
- Codes of practice for shrimp farming – C. Boyd.
- Survey of legal and institutional arrangements – A. Van Houtte.
- Shrimp health management strategies – R.P. Subasinghe.
- Environmental management of shrimp farming in Australia –N. Preston, M. Burford, P. Rothlisberg and C. Jackson.
- Social aspects of coastal shrimp culture in Bangladesh - Anwara Begum.
- Implementation of the Code of Conduct for shrimp farming: Preliminary results from demonstration in Thailand – Siri Tookwinas, Putth Songsangjinda, Krissana Chankaew, M.J. Phillips and Sih Yang Sim.
- Case studies of shrimp culture in north and north central Vietnam - Tran Van Nhuong.
- Case studies on shrimp farming in Ecuador - S. Sonnenholzner, L. Massaut, J. Calderon and C.E. Boyd.
- Belize Aquaculture – Robins Macintosh.
- Shrimp culture in East Africa – Rafael Rafael, J.W. Clay and Fernando Loforte Ribeiro.
- AQUALMA - Mahajamba Ferme, Madagasgar – K. Corpron.
- Global Aquaculture Alliance – G. Chamberlain.
- Industrial Shrimp Action Network (ISANet) - D. Barnhizer.

SESSION II: GOOD MANAGEMENT PRACTICES AND GOOD LEGAL AND INSTITUTIONAL ARRANGEMENTS FOR SUSTAINABLE SHRIMP CULTURE

Chair: Colin Price
Co-chair: Suraphol Pratuangtum
Rapporteurs: Uwe Barg and Greg Paust

23. The session opened with a presentation by Mr Rolf Willmann (FAO) on the background to this Expert Consultation, in particular the recommendations of the Bangkok Consultation on Policies for Sustainable Shrimp Culture, Bangkok, Thailand, 8-11 December 1997, requesting FAO to convene: (1) a technical consultation on the legal and regulatory framework for coastal aquaculture; and (2) a technical consultation on best practices for shrimp culture.

24. Owing to the close relationship between the two subject matters and in order to make efficient use of funds, the decision was taken to consider them in one joint consultation. Mr Willmann also explained that the title 'Good Management Practices' rather than 'Best Management Practices' was adopted because the large variety of culture systems and local and national conditions did preclude the identification of any one best management practice.

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[2] Presented a brief summary of this thematic review, authored by Macintosh *et al.*

25. Subsequent discussions focused on the use of the term "Good management practices"- GMPs. Alternative terms might be "Best management practices and "Better management practices" – BMPs. It was noted that the recommendation from the FAO Bangkok Technical Consultation had used the term "Best practices". Some participants felt that "Better management practices" would be the preferred term, because this term conveyed the sense and opportunity for further improvement. "Good" and "Best" were more static terms. It was decided to retain the term GMPs, recognizing that these differences in terminology and opinions exist.

26. Two working papers were introduced and discussed.

27. ***Operational principles for sustainable shrimp culture - Dan Fegan and John Hambrey.*** A working paper on Operational Principles for Sustainable Shrimp Culture was presented. A definition of the objectives, operating principles, Good Management Practices (GMPs), measurable performance criteria, and constraints to adoption were provided in the presentation. The paper presented formed a basis for subsequent deliberations by the Expert Consultation Working Groups 1 and 2.

Discussion points

28. Participants raised the following points during the subsequent discussion.

29. The costs and benefits of compliance actions and incentives can fall unevenly. The way the shrimp market chain works can mean that the benefits and costs are not necessarily captured or borne at the correct level. The example given was that the cost of health testing of post larvae had resulted in the demise of some hatchery businesses.

30. It was stated that whilst there are real differences in the structure of the shrimp industries in Latin America and Asia the general principles (objectives) for sustainable shrimp culture can be the same. The difference will be in the approaches to implementation of general principles. It was emphasized that it is essential to have standards and a compliance or auditing plan. The priority should be the development of compliance plans ahead of the production of more GMPs. The level of sophistication (literacy and education) of some small farmers in Asia would have a substantial impact on the ability for governments to achieve outcomes. The meeting generally agreed that the need was to focus much more on implementation issues.

31. The issue of feed supply and its impacts where discussed. In India, farmers receive feed supplied on credit up to the point of harvest. The impact of such systems on farmers adopting GMPs was acknowledged. Further, the selections of feed source [given that the formulations are similar] are often on the basis of the credit arrangements offered by the feed supplier.

32. It was noted that the focus in the working paper was on new shrimp farming proposals. The approach to achieve improvements in existing shrimp farm operations should also be considered. The views expressed were that the existing farmers need to focus on adoption of GMPs. However this is unlikely to result in a perfect outcome as it may be impossible to remedy previous poor decisions, for example due to poor site selection, in the short to medium term.

33. The view that GMPs were the final management solution was discussed. It was agreed that the GMPs should not be taken as an end point and there is a need for continuous improvement.

34. In Australia, license arrangements have been adopted to enforce compliance of farms against operating standards. It was elaborated that whilst such arrangements had worked well in Australia, where compliance programmes have been implemented, for a range of reasons [including cultural and political] it is unlikely to be the complete solution in many Asian countries. Education will be very important in achieving change. Market feedback such as occurred with antibiotic residues in shrimp will also drive the adoption of alternative practices. It is also important that the whole production chain addresses the issue rather than one part of the chain, such as the grow-out sector, if good outcomes are to be achieved.

35. ***Good legal and institutional arrangements for sustainable shrimp culture – A. Van Houtte and S. Sen.*** A detailed paper on good legal and institutional arrangements for sustainable development of shrimp culture was presented. This paper was used as a background paper for expert deliberation in Working Group 3.

36. The role of good legal and institutional arrangements is to reduce uncertainty by encouraging sustainable development of shrimp culture and protecting interested parties against negative social, environmental and economic impacts. They are closely related to good management practices in shrimp culture as they depend on, inform and support each other.

37. There are three aspects of legal and institutional arrangements: rules, interested parties and processes. Rules legally include binding and non-binding instruments; interested parties include participants, those who can influence the rules and those who are affected by the rules; and processes include methods which improve co-operation and seek adherence to the rules. The types of interested parties that emerge from the establishment of shrimp culture and how they evolve are fundamentally influenced by rules and processes. In turn, interested parties influence how rules and processes evolve.

38. The approach used to identify elements of good legal and institutional arrangements was based on the review of the surveys of national legislation carried out under the auspices of the FAO Legal Office and any case studies that were available. The target audience for these "elements" was primarily governments. The purpose was not to be too prescriptive and to serve as a discussion document for Working Group 3.

39. Experience suggests that the weakest components of legal and institutional arrangements in shrimp culture have not been the rules *per se* but the processes and parties supporting the development, implementation and enforcement of the rules. For this reason, the presentation and Working Paper 3 addressed these issues first.

40. Processes included reviews of legal and institutional arrangements, consultation with interested parties, environmental impact assessments, extension and training and information dissemination. Key elements of interested parties included criteria for identification, institutional responsibilities and specialist bodies. Rules included land tenure and location licensing as well as continuing controls on shrimp culture.

41. The consultation was asked to review Working Paper 3 to address three aspects: what elements is there consensus on, what elements do participants disagree with, and on what elements is further work required.

Discussion Points

42. The following points were raised during subsequent discussions.

43. The usefulness of the survey of countries' institutional arrangements for the control of aquaculture in terms of identifying models, which have been successful and could be considered for adoption by other governments, was discussed. It was considered that the survey, because it only focussed on the legislative environment and not the effectiveness of the overall management regime, could not by it self be used to determine a preferred model.

44. Ms Van Houtte expressed concern that in the last 10 years there had been little progress in having legislation specific for aquaculture enacted. She considered that linkage of coastal aquaculture with fisheries management legislation was not helpful while the link was essential with coastal zone management legislation or environment legislation.

45. The need for consideration of a range of approaches [rather than just government regulation] such as involvement of industry and co-operative organizations to achieve compliance was discussed. The need to review effectiveness of approaches and make adjustments based on experience was considered to be essential. The use of incentives rather than regulation was discussed.

46. It was pointed out that care would have to be taken in the design and specification of legal and institutional arrangements to minimize the scope for corrupt practices. It was also suggested that civil society organizations could play a useful 'watchdog' role to deter and eliminate corrupt practices where these might be a concern.

47. The need was also identified for regulations that actually protect aquaculturists from the adverse impacts of developments in other sectors. Urban, industrial, agricultural, as well as other aquaculture ventures, can have a detrimental impact on the sustainability of existing farms and render shrimp culture economically unsustainable.

48. The need for shrimp farmers to have secure rights in relation to land and water was seen as critical to achieving long term commitments from farmers to invest in achieving improved environmental management and performance and responsible stewardship of natural resources. Without ownership or quality tenure it was unlikely that the farmers would commit scarce resources to longer-term sustainability objectives. On the other hand, where secure real rights are granted in isolation from an effective regulatory framework, it could open avenues for abuse and irresponsible behaviour.

49. Participants were invited to consider these issues during the Working Group discussions.

SESSION III: WORKING GROUPS

50. Three working groups were convened to discuss the following issues:

51. ***Group I – On-farm level management practices***. The group discussed the objectives and operating principles to attain sustainable on-farm-level management practices. The final version of the Working Paper 1 which includes the final report from this group is given in Annex C.

52. ***Group II – Off farm (sectoral) management practices***. The group discussed the objectives and operating principles for sustainable off-farm "sectoral" management practices. The final version of the Working Paper 1 which includes the final report from this group is given in Annex C.

53. ***Group III – Legal and Institutional arrangements.*** The group discussed good legal and institutional arrangements for sustainable development of shrimp culture. The final version of the Working Paper 3 which includes the final report from this group and the corresponding group in Session V is given in Annex E.

54. The composition of the Working Groups is provided in Annex F.

SESSION IV: DEVELOPMENT OF SPECIFIC GOOD MANAGEMENT PRACTICES AND LEGAL AND INSTITUTIONAL ARRANGEMENTS, AND THEIR IMPLEMENTATION

Chair: Sunil Siriwardena
Co-chair: Rolando Platon
Rapporteurs: Rolf Willmann and Pedro Bueno

55. ***Guidelines for the development and implementation of situation specific GMPs by John Hambrey and Dan Fegan***. In introducing Working Document 2 on Draft Guidelines for the Development and Implementation of Situation Specific GMPs at National or Sub-National Level, John Hambrey listed a range of possible uses of GMPs, including involuntary codes of conduct or codes of practices and their use by government agencies as regulatory tools for permitting decisions on concessionary financing, and benchmarks or criteria of environmental impact assessments (EIAs). GMPs could also play complementary roles in the preparation of aquaculture development plans and environmental management and auditing schemes including ISO 14000 schemes and standard setting.

56. Farmers would, at least in the medium term, be the main beneficiaries of GMPs. The adoption of better farming practices would often reduce rather than increase production costs and result in more stable and higher production in the long run. Other beneficiaries could range from other resource users, neighboring communities, consumers and society at large.

57. The process for the development of GMPs could be initiated by national or local government entities, or by farmers groups and associations, perhaps in cooperation with processors and retailers. Whoever takes the initiative, farmers and their organizations should be closely associated with the development of GMPs and agree with them. GMPs should probably not be overly prescriptive and allow farmers the flexibility to reach the intended outcomes with the best means available to them. The target outcomes need to be clearly specified and performance criteria established.

58. Various measures might have to be taken to assist small farmers in the implementation of GMPs including extension and training, financial incentives, promotion of group farming arrangements (e.g. cluster, estate). Such support is needed to address the special difficulties

and perhaps even reluctance of small farmers to adopt GMPs. These include the inability to take advantage, in the absence of group arrangements, of economies of scale in the adoption of certain practices (e.g. water treatment facilities). More time and effort is also needed to get small farmers sufficiently organized because of their large number. Viable organizations are indispensable for small farmers to realize the benefits of coordinated behavior in, for example, water and health management, and for their participation in product labeling schemes.

Discussion points

59. The ensuing plenary discussion centred largely around the question whether small farmers might be disadvantaged vis-à-vis large farmers in the adoption of GMPs. This could affect the competitive position of small farmers and prevent them benefiting from price premiums attained through eventual certification and labeling schemes. While it was acknowledged that attaining successful collective action among large numbers of small farmers was a challenge, experience in several countries indicated that small producers were often highly receptive in the adoption of better practices and showed high levels of diligence and care in farming activities. The problem lied more in access to latest know how, technology and finance, and in the ability to overcome constraints in the realization of scale economies through group arrangements. Nevertheless, there was agreement that the potential price mark up that might be realized by the adoption of GMPs and participation in eventual product labeling schemes would not generate the kind of financial resources needed in many countries to provide the technical and financial support for wide-spread adoption of GMPs by small farmers. In this regard other possible avenues were mentioned such as levying taxes at the points of export or import, and externally financed assistance projects. Awareness creation, extension, technology transfer, especially in respect to domestication, and measures to ensure that price mark-ups reach small producers were other areas that needed support.

SESSION V: WORKING GROUPS

60. Following the presentation and discussions, the three Working Groups convened again to discuss implementation of the operating principles and good legal and institutional arrangements for sustainable development of shrimp culture. The final version of the Working Paper 2 on Guidelines for the Development and Implementation of Situation Specific Good Management Practices for the Sustainable Development of Shrimp Culture at National or Sub-National Level, which include the reports of the Group I and II of Session V is given in Annex D.

SESSION VI: PRESENTATION OF WORKING GROUP FINDINGS AND RECOMMENDATIONS

Chair: Jim Gillespie
Co-chair: Ron Zweig
Rapporteurs: Rolf Willmann and Michael Phillips

61. The Working Group chairs/rapporteurs made presentations of the findings of each working group.

62. The suggestions made in the plenary session were included in the final Working Group reports that are attached as Annexes C to E.

RECOMMENDATIONS OF THE CONSULTATION AND THE AGREED FOLLOW-UP ACTIONS

63. Following the final discussion session, the Expert Consultation adopted the following recommendations.

64. There is a need for a consultative follow up process after the Expert Consultation.

65. This process should initially involve finalizing the report of the Expert Consultation, including revision of the working group reports, taking account of the issues raised during plenary discussions and particularly to ensure conformity and links between objectives, on- and off-farm operating principles and GLIAs.

66. The process should then bring together practical examples on GMPs and identify mechanisms to support their implementation. The following are recommended:

i) Further identification of GMPs and GLIAs to implement operating principles based on case studies and other material by the WB/NACA/WWF/FAO consortium;

ii) Estimation of qualitative and quantitative costs and benefits of implementation of GMPs/operating principles. Financial and economic analyses of best compared to worst practices were recommended; the analyses would take into account the applicability of GMPs at different levels from generic to farm levels;

iii) Identification of performance criteria to monitor the effectiveness of operating principles, GMPs and GLIAs, taking into account the need for cost-effective monitoring based on a limited number of key indicators;

iv) Special attention to identification of GMPs and GLIAs for "retrofitting" of large numbers of existing farms and mobilization of required technical and financial support;

v) FAO and other agencies should produce and share information on development and implementation of GMPs and GLIAs;

vi) The World Bank/NACA/WWF/FAO Consortium is requested to take responsibility for collating information on management practices as identified above, making further extensive use of the existing case materials from the Consortium work and other relevant sources.

vii) In the process of developing the GMPs documentation recommended by the Expert Consultation, linkage and exchange of experiences with farmers associations, governments, academic and research institutions, professional associations, non-government organizations and other organizations with experience and insight is strongly encouraged.

67. The Expert Consultation recommends that a document on the objectives and operating principles, and the legal and institutional arrangements to support implementation, be prepared for presentation to an intergovernmental forum for formal adoption. The Expert Consultation requests FAO to facilitate this process.

68. The Expert Consultation considered that two issues in particular have to be addressed in the process of further development and implementation of GMPs: (a) that farmers associations have a particularly important role in development and implementation of GMPs, particularly for small-scale farmers; and (b) dialogue and co-operation between farmers associations, government organizations, seafood export associations, and other stakeholders is required in the development and implementation of GMPs. In this regard, the Expert Consultation made the following recommendations:

i) Preparation of a review of farmers associations, identifying the factors for success, to provide practical guidance on development and operation of successful farmers associations;

ii) Promotion of meetings of farmers associations to review and develop GMPs in co-operation with relevant government agencies, where desirable;

iii) Promotion of dialogue and co-operation between farmers associations, government organizations, seafood export associations and other stakeholders in development and implementation of GMPs;

iv) More effective networking among shrimp farmers associations is required, and a regional shrimp farmers network may be particularly useful in Asia. The Expert Consultation requested NACA to facilitate a meeting of shrimp farmers associations in Asia. The agenda should be driven by the farmers associations;

69. The Expert Consultation recommended the following additional measures be promoted to facilitate the development and implementation of GMPs and GLIAs in shrimp culture:

i) Preparation of a review that will bring together experiences in success and failure in management of farm clusters and nucleus estates. Such a document can provide guidelines on how such nucleus estates might work best;

ii) Preparation of an evaluation of the potential use of the operating principles as basis for investment and buyer screens, providing an incentive for investments in farms operating according to good management practices;

iii) Elaboration of best practices for government–farmer consultation and co-operation at various levels (i.e. central, provincial and local levels) in the development and implementation of GMPs and GLIAs;

iv) Financial and technical assistance be directed to support development and implementation of GMPs and GLIAs, with special attention to small-scale farmers and farmers associations;

v) Further evaluation of existing Codes of Conduct and implementation plans be carried out to assess their universal application.

CLOSING CEREMONY

70. The Expert Consultation was closed with remarks from FAO and the Government of Australia. The speakers thanked the participants for their active and fruitful involvement in the meeting, and looked forward to further co-operation in the implementation of the recommendations.

ANNEX A: AGENDA OF THE EXPERT CONSULTATION

Monday 4 December 2000

Opening session:	Welcome addresses and introduction to the objectives and expected output from the Expert Consultation
Session I:	Towards Identifying Good Management Practices and Institutional and Legal Arrangements for Sustainable Shrimp Culture: Experiences and Lessons. Presentation and discussion of thematic reviews from the World Bank/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment, country case studies and experiences of other shrimp farming initiatives.

Tuesday 5 December 2000

Session II:	Good management practices and legal and institutional arrangements for sustainable shrimp culture Presentation and discussion of two working paper on: (a) elements of good management practices for sustainable shrimp culture; and (b) elements of good legal and institutional arrangements for sustainable shrimp culture
Session III:	Working Groups Working Group I: Farm level good management practices Working Group II: Off farm good management practices Working Group III: Good legal and institutional arrangements

Wednesday 6 December 2000

Session IV:	Development of Specific Good Management Practices and Legal and Institutional Arrangements for Sustainable Shrimp Culture, and their Implementation Presentation and discussion on: (a) formulating guidelines for developing specific GMPs for sustainable shrimp culture and their implementation; and (b) formulating guidelines for developing specific GLIAs for sustainable shrimp culture and their implementation
Session V:	Working Groups (continued) Working Group I: Farm level good management practices Working Group II: Off farm good management practices Working Group III: Good legal and institutional arrangements

Thursday 7 December 2000

Session VI:	Presentation of Working Group Findings and Recommendations Plenary presentations and discussion of working group findings. Development and adoption of follow up recommendations.

Closing ceremony

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ANNEX C: WORKING PAPER ON OPERATING PRINCIPLES FOR SUSTAINABLE SHRIMP CULTURE[1]

Purpose of this document

This Working Paper attempts to synthesize and distil the core elements to be found in the various documents that propose operating principles and management practices for sustainable shrimp farming. In so doing it takes account of the diversity of shrimp farming and development conditions throughout the world. It is therefore generic in nature, and aims to focus attention on key areas of operation, and the various possible routes to sustainable shrimp culture, rather than prescribing in detail appropriate management practices. The term "operating principles" rather than "generic good management practices" has therefore been used throughout this document.

A section on farm group or sector level operating principles is also included, since incentives to comply with many farm-level operating principles will depend upon collective action by groups of farmers within an aquatic system. This is particularly important where small-scale farmers, each of who may have a limited capability to influence the sector sustainability but who collectively have a major impact and without whose contribution efforts aimed at promoting sustainability will be severely hampered, dominate the sector. Furthermore several of the sustainable development objectives that form the rationale for compliance will not be achieved without organized and collective action.

Although this paper, as with most existing codes, will focus on operating principles, it should be recognized that farmers alone do not represent the entire shrimp farming sector and that there are many ancillary activities that will have an impact on the development and the adoption of specific GMPs. Broodstock suppliers and hatcheries represent an important production sector whose activities and management practices have a major bearing on an individual farmer's ability to comply with the operating principles presented here, and corresponding GMPs. On the supplier side, companies or individuals providing farmers with goods or services also have a significant role to play in supporting and encouraging GMPs. Feed and chemical suppliers in particular can have a major impact on the development of GMPs through improvements in their products and by extending knowledge about their proper use. It is outside the scope of this consultation to consider the roles of input suppliers in detail. However, these should be considered in any future discussion on the development and implementation of GMPs for shrimp culture. These issues are discussed in more detail in the Working Paper "Guidelines for the Development and Implementation of Situation-specific GMPs at the National or Sub-national Level".

In developing this working paper a wide range of documents have been consulted, specifically the various existing codes of practice as well as a number of case studies which have been developed as part of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment.

It is not possible to be highly specific in terms of universal good management practices due to the diversity of culture systems employed, site and location specific factors and the rapid rate of development of the technology associated with pond and farm management techniques. In addition, market factors play a role in the economic feasibility of particular practices. Nonetheless, it is possible to define a set of *operating principles* that might serve as the basis for developing situation specific GMPs.

The document therefore provides: (1) To provide an overview and synthesis of core elements of the various codes of conduct for shrimp culture which have recently been developed or are under development in various countries; and (2) Building on this synthesis, the various case studies undertaken under the WB/NACA/FAO/WWF initiative, and the FAO Code of Conduct for Responsible Fisheries, to provide a draft set of *operating principles* that are widely applicable in shrimp culture throughout the world.

Some possibilities for measuring performance (Performance Criteria) are also given, and these should be further developed and refined in relation to specific management practices developed at local level. These criteria should be as objective as possible, and form an integral part of the overall process of identifying and agreeing GMPs[2].

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[1] The first draft of this working paper was prepared by D. Fegan and J. Hambrey. The document presented here is a further development of the paper by Working Groups 1 and 2 during the Expert Consultation.

[2] Constraints to the implementation of the Operating Principles were not discussed by working groups and are not included in the report.

The accompanying working paper, "Draft Guidelines for the Development and Implementation of Situation-specific GMPs at the National or Sub-national Level", discusses in detail how the operating principles presented here might be adapted and implemented in specific situations.

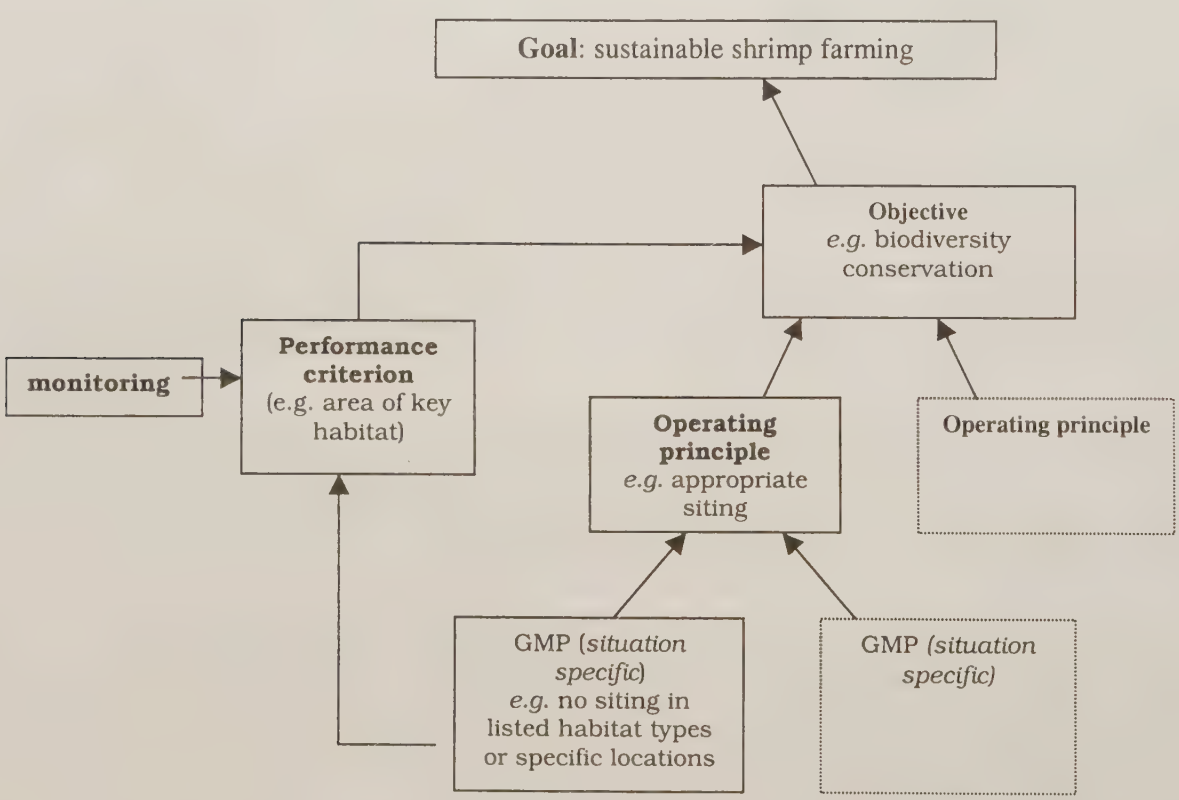
Introduction and background

Overview of existing Codes[3]

Many of the existing codes appear to be based on the traditional model of earthen pond farm systems. However, recent developments in intensive culture systems and recirculation technology may have a significant impact on existing GMPs[4]. For example, many of the GMPs related to site selection recommend the avoidance of sandy soils and the need for a good supply of clean water of a given quality. However, as lining ponds becomes more economical, the need for a strong emphasis on soil quality characteristics is much reduced. Similarly, as the technology for water treatment and water quality improvement develops, there may be less need to focus on water supplies that meet strict criteria as long as the source water quality can be economically improved.

What are referred to as GMPs or BMPs in the various codes actually represent a mixture of items varying from re-statements of objectives and principles to specific farm practices. In some cases, individual farm GMPs and wider sector management objectives are included under the same heading. Very few of the codes set down clear objectives or criteria for the proposed "good" management practices, nor do they offer clear performance criteria for measuring or evaluating the success of the GMPs in meeting objectives.

Figure 1: A hierarchical structure to facilitate the rational development of situation specific GMPs



[3] For a comprehensive review of the existing codes see review by Boyd and Hargreaves (2000).
[4] See for example case studies from China (Durriapah and Huang, 2000) and Belize (Boyd and Clay, 2000).

A framework for the development of situation specific GMPs.
The following sections present a set of objectives corresponding to the various dimensions of sustainable development, a set of operating principles which should contribute to the achievement of these objectives, and some performance criteria which should allow for the measurement of progress (Figure 1). The operating principles, and associated performance criteria should provide a clear basis and starting point for the development of situation specific GMPs. Practical guidance on how to go about this is found in the accompanying working paper *Guidelines for the Development and Implementation of Situation-specific GMPs at the National or Sub-national Level.*

Costs and benefits of adopting GMPs
Cost of implementation is a major constraint to some of the operating principles, especially for small farmers. Many small farmers from rural communities in developing countries focus on short-term profitability. Where rice farmers have converted to shrimp farming, for example, the massive disparity between incomes from rice and shrimp as a crop, tend to convince farmers that the risk, even when it is thought to be high, is worth the reward.

Although ideally a GMP would carry no cost penalty it is possible that farmers who adopt and comply with some GMPs will experience in the short run a reduction in profitability due to higher production costs[5]. In the long run, the adoption of GMPs, if widely and consistently applied at the individual farm and sector levels, would be expected to result in a higher, more stable and more valuable production output. Moreover, compliance with a recognized system of GMPs may deliver a price premium to the producer because the product is viewed to have been produced in a responsible manner, yielding high and consistent product quality and conforming with social and environmental objectives. However, at present, there is very little evidence of trickle-down benefits arising from adoption of GMPs. One barrier to this, especially in Asian countries, is the system of selling shrimp through brokers or auctions at major markets. This effectively breaks the link between the producer and the processor.

It is therefore important to determine the marginal benefits and costs accruing to the farmer, or group of farmers, from the implementation of GMPs. If the net benefit of adopting GMPs is positive, then farmers will be more likely to adopt the GMPs. However, where the benefits of adopting GMPs are not obvious or are insufficient (through increased costs or reduced profitability) farmers may not adopt the GMPs. In these situations, second best options may need to be looked at and a combination of GMPs which currently produce the highest net benefits and a strategy for continuous efforts for further improvements may be the best solution.

Objectives for 'good' management practices

It is proposed that *good* management practices are those that make aquaculture more sustainable and more successful. The FAO definition of sustainable development is as follows:

Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

In order to promote sustainable development as defined here, and in order to address the specific problems and opportunities associated with shrimp farming described in the accompanying document (Draft Guidelines for the Development and Implementation of Situation-specific GMPs at the National or Sub-national Level), the following **objectives** are proposed for different GMPs or sets of GMPs. These objectives for sustainable development of shrimp culture were discussed and agreed by the Expert Consultation. These encompass the objectives implicit in the General Principles of the FAO Code of Conduct for Responsible Fisheries. They are framed as objectives rather than principles so that progress or performance can be measured against them.

Objective 1: Use land and water which is suitable for sustained shrimp production
Objective 2: Conserve sensitive aquatic habitats and important ecosystem functions
Objective 3: Manage soil resources and earthworks to minimize impacts on surrounding environments
Objective 4: Minimize impacts on local water resources
Objective 5: Avoid release or escape of exotic species and transgenics into the environment

[5] Although some GMPs associated with e.g. improved food conversion efficiency, should yield financial benefits.

Objective 6: Responsible use of chemicals that may impact adversely on ecosystems and human health
Objective 7: Maximize efficiency of resource use and minimize waste outputs
Objective 8: Reduce dependence on wild stocks for farmed shrimp production
Objective 9: Implement shrimp health practices to reduce risks of disease in farmed and wild stocks
Objective 10: Optimize social and economic benefits to the wider community and country
Objective 11: Conduct shrimp farm operations to minimize impacts on surrounding resource users
Objective 12: Ensure the rights and welfare of staff in farm operations

These objectives for sustainable shrimp culture should not be considered in isolation and are considered to be widely relevant, although priorities and requirements for implementation may vary between farms and countries.

In some cases it may be necessary to adopt a suite of GMPs in order to meet one of these objectives. Conversely, some GMPs will contribute to several of these objectives.

Ideally, objectives to promote "sustainable" aquaculture would automatically lead to "successful" aquaculture. It is important to define clearly what is meant by "successful" aquaculture and to establish and agree realistic objectives for success, including the time frame for their impact. From a business standpoint, GMPs should preferably demonstrate a clear benefit, either tangible (reduced costs, higher profits) or intangible (better reputation, reduced potential for conflict). Business objectives[6] associated with the adoption of GMPs might include:

- Maximize return on investment within a reasonable time frame while meeting the sustainability objectives
- Maximize benefits of compliance (both tangible and intangible) to farmers
- Ensure that the benefits of compliance can be captured at all points in the value chain;
- Maximize long-term added value

Farm level operating principles

The following general-operating principles should help farmers meet many of the objectives listed above.

Shrimp farmers should:

- Comply with all legal and regulatory requirements governing the placement, management and operation of the farm.
- Strive to understand the nature of their business and the management and operation of a shrimp farm.
- Keep abreast of new developments in the practice of responsible shrimp farming.
- Associate with others to establish effective representational and organizational structures so that the effects of groups of farms can be adequately managed and reported, and so that agreement on appropriate group level action to promote sustainability can be reached and implemented.
- Establish an effective farm level monitoring and reporting system. This should include, at minimum, regular checks and reporting on:
  - Water quality;
  - Feeding times and quantities;
  - Production parameters (stock growth, biomass, mortality estimates etc.)
  - Stock health;
  - Chemical use;
  - Effluent water quantity and quality; and
  - expenditure and income
- Ensure that farm staff are adequately trained in shrimp husbandry and understand the principles of environmentally responsible shrimp production.
- Apply the *precautionary approach* (i.e. farmers should more carefully plan and rigorously evaluate developments and activities that have uncertain implications for the environment.).
- Purchase only comprehensively labeled products produced in line with manufacturing standards and that are appropriate for the use to which they are put.
- Insist that suppliers provide appropriate and reliable information on their products and their use.
- Continually strive to improve production and environmental standards within reasonable business constraints.

Investors and owners of shrimp farms should:

- commit to a long-term investment and strive towards consistent, efficient production of shrimp in an environmentally and socially responsible manner.

Performance criteria:

- Farm owners possess clear title or right to the land or some other legal land concession agreement.
- Where required, appropriate permits available and up to date.
- Existence of an environmental monitoring programme.
- Adequate records available for inspection (production, environment and feed/chemical use).
- Purchasing standards for supplies are available and adhered to.
- Farm manual of production procedures or standard operating procedure.
- Staff qualifications and length of service.

The constraints to these general principles may include:

- Lack of appropriate legal and regulatory framework or poor enforcement of existing framework.
- Size and cost limitations for individual small farm EIAs. Where small farms predominate it would be impractical for every farm to conduct its own EIA. The cost of conducting a meaningful EIA would also be prohibitive for small-scale farmers.
- In many areas, particularly where a zoning system for aquaculture does not exist, small farms develop gradually, generally following the success of the initial farms operations. It would be impractical and unreasonable to expect the first few small farms to conduct an EIA to cover the extent of eventual development. In such cases, no mechanisms may be available to ensure that shrimp farm development does not exceed the maximum sustainable level for the area.
- Lack of agreed methods to determine "carrying capacity" or "maximum sustainable production capacity" of a given environment or area.
- Farmers record keeping – lack of appreciation of record keeping, literacy rates of farm staff.
- Availability of adequately educated or qualified staff.
- Quality of available inputs not often under the control of the farmer

Objective 1: ***Use land and water which is suitable for sustained shrimp production***
Objective 2: ***Conserve sensitive aquatic habitats and important ecosystem functions***[6]

Operating principles at the farm level

- Construct new ponds after following a rigorous site selection process (components of the site selection process need to be elaborated as part of a system of GMPs)
- Existing farms should plan expansions, modifications and operation to comply with agreed criteria (criteria could be either described in a system of GMPs or mandated by regulations)

Objective 3: Manage soil resources and earthworks to minimize impacts on surrounding environments

Operating principles at the farm level

- Employ techniques and engineering practices to minimize erosion and salinisation during construction and operation.
- Employ techniques to minimize disturbance of acid-sulfate soils during construction and operation.
- Minimize creation of degraded areas such as unused soil piles and borrow pits

Objective 4: Minimize impacts on local water resources

Operating principles at the farm level

- Optimize quality of discharge into natural water systems
- Minimize impacts of water use on hydraulics of natural water systems
- Minimize physical and chemical impacts on ground water resources

[6] The operating principles for these two objectives have been combined.

Objective 5: Avoid release or escape of exotic species and transgenics into the environment

Operating principles at the farm level

- Farmers should undertake to work with local species except where introductions have been made responsibly and following appropriate protocols and safeguards;
- Conform with national and international protocols on the transfer and introduction of alien species;
- Where alien species or non-native strains are used, take maximum precautions to prevent escape of introduced stocks;
- Transgenics should only be used where such use has official approval and after appropriate safeguards have been put in place to avoid adverse environmental effects

Objective 6: Responsible use of chemicals that may impact adversely on ecosystems and human health

Operating principles at the farm level

- Chemicals should be used as little as possible, consistent with the need to maintain pond environment and shrimp health
- Records should be maintained regarding use of chemicals in ponds and hatcheries
- Train farm staff in safe handling of chemicals
- Ensure that chemicals used are effective for the purpose and are used in accordance with standard techniques or manufacturers' instructions regarding dosage, withdrawal period, proper use, storage, disposal, and other constraints on the use of a chemical including environmental, human and food safety precautions.

Objective 7: Maximize efficiency of resource use and minimize waste outputs

Operating principles at the farm level

- Carefully monitor use of essential resources on the farm and adopt a strategy for maximizing efficiency in their use

Objective 8: Reduce dependence on wild stocks for farmed shrimp production

Operating principles at the farm level

- Preserve genetic diversity of natural stocks
- Use hatchery-reared postlarvae and domestication to enhance culture performance and health

Objective 9: Implement shrimp health practices to reduce risks of disease in farmed and wild stocks

Operating principles at the farm level

- Maintain biosecurity
- Implement technologies (health management protocols) that reduce stress
- Ensuring good quality standards of shrimp post-larvae
- Responsible trans-boundary movement of live shrimp
- Implement management strategies to avoid spread of shrimp disease off farm

Objective 10: Optimize social and economic benefits to the wider community and country

Operating principles at the farm level

- Being socially responsible within community standards and values
- Encourage participation of local people in shrimp culture

Objective 11: Conduct shrimp farm operations to minimize impacts on surrounding resource users

- Conduct shrimp farm operations to minimize impacts on surrounding resource users

Objective 12: Ensure the rights and welfare of staff in farm operations

Operating principles at the farm level

- Governments should develop and implement appropriate labor regulations for shrimp farm activities
- Conform to all relevant national labor regulations
- Maintain healthy and safe living and working conditions
- Provide appropriate channels to address staff grievances

Sector level operating principles

Many of the problems associated with shrimp culture could, in theory, be addressed by the widespread adoption of farm level good management practices based on the foregoing principles. However, such an approach cannot fully address issues associated with environmental capacity, and certain aspects of disease management. While an individual farm adopting GMPs may have minimal impact on the environment, a large number of such farms will eventually face problems related to the density and pattern of development, cumulative impacts on water quality, and steadily increased risk of disease exchange and spread[7]. Furthermore, shrimp farmers may find themselves at risk as a result of steadily declining water quality related to the activities of other resource users. Co-ordinated and co-operative action will be required to address these problems, initiated either by government, or by associations of small farmers. In some cases more integrated management of all activities utilizing an aquatic system may be required – in other words, more integrated coastal management.

While the problem is implicitly recognized in several existing codes of practice, explicit solutions are few. In Sri Lanka, specific recommendations have been made to organize small farms in "clusters" for management purposes. Other recommendations typically concern improved information about levels of shrimp farming activity, through registration, licensing and monitoring procedures.

Most of the objectives for GMPs relate to environmental quality within an aquatic system, and socio-economic well-being in general. Performance in meeting these objectives cannot be measured at farm level. Some performance monitoring must therefore take place at a higher level, and this again will require government initiatives and/or co-operative action by farmers. Since these are general issues of interest to all sectors, it makes sense for the government to play a co-ordinating role in this – even if this is restricted to promotion and facilitation.

Conflict related to shrimp farm development has often arisen as a result of ambiguities in use rights and title to land/water in the coastal zone. Again, farm level GMPs cannot adequately address this problem.

The incentive to comply with many GMPs will depend on the ability of the farmer to capture the benefits of compliance. Many of these benefits will only be realized if the majority (and in some cases all) of farmers within a specified aquatic system adopt the GMPs. In other words collective adoption will be required to achieve collective benefits.

A final problem relates to consistency of approach between sectors. If, for example, shrimp farming GMPs do not allow for development in certain habitat types (such as mangrove) then for this to be effective, similar codes need to be established for agriculture and charcoal making; and forestry in mangrove areas should adopt GMPs designed to promote its biodiversity, and its functions as nursery areas or protection zones. Furthermore, as noted under the farm level GMPs, government or associations of user groups must agree on the nature of valuable habitat and ecosystem functions and how they are to be conserved before appropriate farm level GMPs can be developed and adopted.

General

Governments should establish a registration and reporting system for shrimp culture. There is a strong case for the introduction of a permit system. Without such a system, the pressure which governments can place on shrimp farmers to behave responsibly will always be limited.

Groups of farmers operating within a particular aquatic system, should form an association or representative body. Where this does not occur through direct self interest of farmers, governments

[7] This problem is far more obvious and critical in the case of large numbers of small scale developments in developing countries.

should consider making this a condition for operating permit. Without such an association the burden on governments to manage the sector will be very high.

Governments should collaborate with shrimp farmers and other stakeholders to produce sustainable aquaculture development plans (ideally as components in integrated coastal management plans) for defined aquatic systems; such plans should incorporate codes of conduct and practice, and take full account of the interests of other resource users.

A system for reporting the quality of the environment and socio-economic conditions, on an annual basis, for defined aquatic systems associated with the activities of a specified group of farmers, should be developed by governments and/or farmer associations.

Objective 1: Use land and water which is suitable for sustained shrimp production
Objective 2: Conserve sensitive aquatic habitats and important ecosystem functions[8]

Operating principles at the sector (off-farm) level

- Existing farms should plan expansions, modifications and operation to comply with agreed criteria Governments should promote shrimp farm development through selected integrated coastal area planning and management procedures, as applicable to local circumstances, with special emphasis on :
  - protection of critical habitats;
  - assimilative capacity of water bodies exposed to shrimp farm effluent;
  - encouraging collective action in farm clusters, i.e. large areas covered by many farms - this may include collective approaches to multiple effluent management, joint liability schemes for co-operative management or even re-development of the farm cluster areas.
- Governments should ensure that use and property rights are clearly defined in the coastal zone, and that these are compatible with Objective 10 (Optimize social and economic benefits to the wider community and country)
- Governments should make information available on suitable site selection criteria for shrimp farming, and identify locations and possibly zones suitable for shrimp farm development. In identifying such criteria, locations and zones, governments should take due account of:
  - the range of site conditions suited to different kinds of shrimp culture;
  - the potential of sites for alternative activities;
  - the interests of other resource users;
  - the practical issues of land ownership and access;
  - the location and functioning of valuable habitat and physical ecosystem functions;
  - desirability of transparency in planning and approval processes.
- Shrimp culture should be integrated into rural development planning, as it has potential for poverty alleviation through direct involvement of rural people in aquaculture production, as well as through employment and or involvement in off-farm activities.

Objective 3: Manage soil resources and earthworks to minimize impacts on surrounding environments

Operating principles at the sector (off-farm) level

- Zoning and site selection should include consideration of soil characteristics, suitability and appropriate use.
- In granting permits or licenses proponents should be required to demonstrate how the following issues will be addressed:(the following as examples):
  - land clearing/vegetation management
  - avoidance or management of Potential Acid Sulfate Soils (PASS) or Acid Sulfate Soils (ASS) during construction.
  - stormwater management during construction and operation
  - contingency plans for failure of environmental control measures
  - rehabilitation measures in the event of a failed or abandoned venture, (e.g. lodging an environmental bond)
  - design to minimize erosion
- Environmental performance criteria, standards and type of assessment, for new and existing farms, for example;

[8] The operating principles for these two objectives have been combined.

Performance criteria

- Annual performance audit by licensing authority or certified third party. Incentive based, poor performance results in increased level of inspection (with increased costs). Good performance rewarded with reduced audit frequency (reduced costs)
- Random or scheduled compliance monitoring
- Inspection in response to self reported emergency
- Inspection in response to complaint

Objective 4: Minimize impacts on local water resources

Operating principles at the sector (off-farm) level

- Government and/or farmer associations, in collaboration with other water resource users, should agree on appropriate quality standards for local water resources.
- Government and/or farmer associations should develop and implement a strategy to maintain these standards.

Performance criteria

- Water resource standards not exceeded

Objective 5: Avoid release or escape of exotic species and transgenics into the environment

Operating principles at the sector (off-farm) level

- Translocation has two components, genetic and disease. Issues to be considered include:
  - displacement or loss of native species;
  - habitat modification, destruction or loss;
  - changes to or loss of genetic diversity
- Translocation issues should also be considered as part of an Import Risk Assessment.
- Governments should enforce internationally and nationally agreed protocols in respect of release of exotic species or genetically modified organisms.
- Develop regulatory mechanisms for the safe introduction of exotic species.
- Develop capacity for the safe introduction of exotic species where these are approved.
- Where suitable native species are available, they should be used in preference to the introduction of exotic species.

Performance criteria

- Impact of escapes

Objective 6: Responsible use of chemicals that may impact adversely on ecosystems and human health

Operating principles at the sector (off-farm) level

- Government should establish regulations relating to the safe use and handling of chemicals for use in aquaculture and other activities;
- Government and/or farmer associations and/or industry should provide information, training and facilities on disease diagnosis and correct treatment protocols, and in relation to other uses of chemicals;
- Government should prohibit the unrestricted sale of antibiotics whose unregulated use could undermine their effectiveness in the treatment of human disease.

Performance criteria

- Regulations published and complied with.
- Frequency and quantity of chemicals used in sample areas.
- Ecosystem and human health not adversely affected

Objective 7: Maximize efficiency of resource use and minimize waste outputs

Operating principles at the sector (off-farm) level

- Governments and producer associations should promote the use of management systems and technology that makes efficient use of resources such as PL, water, chemicals, land, energy and labor.
- Government should promote the supply of safe, high quality feeds for shrimp culture in line with guidelines for good practice for manufacturing and use. Governments should encourage companies to provide information on nutrition and ingredients on feed labels.

- Governments and producer associations should encourage the use of settlement facilities and bio-remediation to reduce waste outputs and encourage the creation of marketable by-products.
- Farmer organizations should monitor and evaluate feed use and performance amongst their members, and provide periodic reports on these issues to their members, feed manufacturers and relevant government agencies.
- Government extension services should promote farming systems which are compatible with the use of local resources.
- Government and producer organizations should encourage the development of markets for waste-based by-products (e.g. sludge, shrimp processing wastes) and/or share information on viable markets.

Objective 8: Reduce dependence on wild stocks for farmed shrimp production

Operating principles at the farm level

- Preserve genetic diversity of natural stocks.
- Use hatchery-reared postlarvae and domestication to enhance culture performance and health.

Objective 9: Implement shrimp health practices to reduce risks of disease in farmed and wild stocks

Operating principles at the sector (off-farm) level

- Governments should develop National Strategies and Policy Frameworks to support shrimp health management. Key points among the strategies would be:
  - Commitment to development and implementation of a Shrimp Health Plan within the National Aquatic Animal Health Programme. The plan to be implemented in a phased manner consistent with capability, resources and priority. In particular, capacity building and development of infrastructure; and
  - Development of protocols on movement and compliance should be consistent with existing protocols and agreements, namely the 'Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals' and the International Aquatic animal Health Code 3rd edition Office International des Epizooties (OIE), which are designed to address the requirements of the WTO SPS.
- Key Components of a Shrimp Health Plan within the National Aquatic Animal Health Programme
  - Health Certification and Quarantine Measures including methods for screening and diagnostics;
  - Disease Surveillance and Reporting;
  - Zoning;
  - Import Risk Analysis;
  - Adequate data for epidemiological analysis;
  - Development of Regional Identification and Diagnostics Resource Centres servicing a number of countries; and
  - Shrimp disease problems are a trans-boundary issue requiring regional and international co-operation.
- Development of Regional Shrimp Health Management Plans for zoning, movement, surveillance and quarantine issues.
- Accreditation of hatchery practices for production of good quality post larvae or extending to production of 'high health' or specific pathogen free (SPF) post larvae.
- Development of regional disease diagnostic capability levels 1-3 as appropriate.
- Carry out on-farm trials of disease management practices and disseminate validated programmes through extension.

Objective 10: Optimize social and economic benefits to the wider community and country

Operating principles at the sector (off-farm) level

- Governments and producer associations should work together to insure that producers obey all laws relating to their operations.
- Governments and producer associations should work to insure the rights of those individuals and communities who choose to take part in the shrimp farming sector as well as those who choose to purse their traditional use of resources.

- Governments and producer associations should recognize the social and environmental impacts of operational failures and take all reasonable steps to reduce the rate of failure in shrimp farming.
- Governments should facilitate the ability of all resource users to address resource conflict issues.
- Governments should work with the private sector to maximize the social benefits of shrimp culture to a wider community through the development of such initiatives as public or joint venture operations, value-added processing, and infrastructural development.

Objective 11: Conduct shrimp farm operations to minimize impacts on surrounding resource users

Operating principles at the sector (off-farm) level

- Governments should ensure that zoning and access to resources is transparent and that all interested parties are consulted in the process.
- Governments should ensure that resource use and rights are clearly defined and compatible for all resource users in the coastal zone.
- Governments should identify suitable zones for shrimp farming. The identification of such zones should take into account:
  - The potential of sites for other activities;
  - The interests of other resource owners/users; and
  - The location of critical ecosystems for human use

Objective 12: Ensure the rights and welfare of staff in farm operations

Operating principles at the sector (off-farm) level

- Government in consultation with the private sector to develop and enforce standards compatible with international standards in relation to health and safety specifically relating to aquaculture.
- Government and farmer associations to raise awareness of standards and promote compliance.

Performance criteria

- List of farm staff.
- Farm staff health – frequency of farm related accidents.

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Although only some are referred to in the text, all of the following documents have served as basic resource material in the preparation of this discussion paper.

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ANNEX D: WORKING PAPER ON GUIDELINES FOR THE DEVELOPMENT AND IMPLEMENTATION OF SITUATION SPECIFIC GOOD MANAGEMENT PRACTICES FOR THE SUSTAINABLE DEVELOPMENT OF SHRIMP CULTURE AT NATIONAL OR SUB-NATIONAL LEVEL[1]

Foreword

The accompanying working paper, "Operating Principles for Sustainable Shrimp Culture" (Annex C), provides a broad framework for good management practices, identifying the main farm operations where good management practices might effectively be applied, and providing examples of specific practices that may be appropriate according to site, technology and local circumstances.

This document provides guidelines for the development and implementation of situation-specific GMPs at the national or sub-national level. These guidelines relate to, *inter alia*, the identification of situation-specific issues, the methodology for cost-benefit analysis of GMPs; stakeholder participation, a constraint analysis for the adoption of GMPs and how to overcome them, including strategies to support farmers and farmer organizations in implementing better management practices is also provide.

The working paper is based on discussion and development of a comprehensive draft document prepared before and subsequent discussions by working groups during the Expert Consultation. Many documents have served as resource material in the development of this paper, particularly those produced as part of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment.

Objectives for 'good' management practices

In the previous working paper, it is proposed that *good* management practices are those that make aquaculture more sustainable and more successful. The FAO definition of sustainable development is as follows:

Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

In order to promote sustainable development as defined here, the following **objectives** have been proposed by the Expert Consultation for different GMPs or sets of GMPs. These encompass the objectives implicit in the General Principles of the FAO Code of Conduct for Responsible Fisheries. They are framed as objectives rather than principles so that progress or performance can be measured against them.

Objective 1:	Use land and water which is suitable for sustained shrimp production
Objective 2:	Conserve sensitive aquatic habitats and important ecosystem functions
Objective 3:	Manage soil resources and earthworks to minimize impacts on surrounding environments
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Objective 6:	Responsible use of chemicals that may impact adversely on ecosystems and human health
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Objective 9:	Implement shrimp health practices to reduce risks of disease in farmed and wild stocks
Objective 10:	Optimize social and economic benefits to the wider community and country
Objective 11:	Conduct shrimp farm operations to minimize impacts on surrounding resource users
Objective 12:	Ensure the rights and welfare of staff in farm operations

[1] The draft of this working paper was prepared for the Expert Consultation by J. Hambrey and D. Fegan. The document presented here is a further development of the paper by Working Groups 1 and 2 during the Expert Consultation.

These objectives for sustainable shrimp culture should not be considered in isolation and are considered to be widely relevant, although priorities and requirements for implementation may vary between farms and countries.

In some cases it may be necessary to adopt a suite of GMPs in order to meet one of these objectives. Conversely, some GMPs will contribute to several of these objectives.

Ideally, objectives to promote "sustainable" aquaculture would automatically lead to "successful" aquaculture. It is important to define clearly what is meant by "successful" aquaculture and to establish and agree realistic objectives for success, including the time frame for their impact. From a business standpoint, GMPs should preferably demonstrate a clear benefit, either tangible (reduced costs, higher profits) or intangible (better reputation, reduced potential for conflict). Business objectives[6] associated with the adoption of GMPs might include:

- Maximize return on investment within a reasonable time frame while meeting the sustainability objectives;
- Maximize benefits of compliance (both tangible and intangible) to farmers;
- Ensure that the benefits of compliance can be captured at all points in the value chain; and
- Maximize long term added value.

This document provides guidelines that can be used to take the operating principles based on these objectives to a more situation specific national or sub-national level.

How can GMPs be used?

A set of GMPs packaged together with statements of policy, principle and commitment may be developed as a code of conduct or code of practice (the latter implies something more detailed and practical than the former). Such a code may be used in various ways.

A farmer, or an association of farmers, may make a voluntary commitment to abide by a code. Typically this would be used to enhance the reputation of the farmer or association, and demonstrate social and environmental responsibility. This in turn may enhance the value of the company and the price of the product. This process may be formalized through certification and labeling. In this way GMPs can be used in the marketing of shrimp and shrimp products as an additional aid, assuring the consumer that the shrimp are being grown under conditions that are environmentally and socially responsible.

Government or NGOs may use a code to guide and influence the private sector. A code may be promoted through education and extension to raise standards and heighten awareness.

GMPs may be used by government as a regulatory tool. For example, agreement to a code, or specific GMPs, may be a pre-condition for a permit to use land/water for shrimp farming, or for a grant or credit offered as part of a development programme.

A code of practice, or a subset of GMPs, may be used in environmental impact assessment as a bench mark for screening and assessing location, design, technology and management for a proposed shrimp farm. Full and demonstrated compliance with a government-approved code might, for example, automatically exempt a proposal from full EIA, while partial compliance, or compliance with certain elements only might automatically require full EIA.

A set of GMPs, not packaged in any particular way, and not associated with statements of policy, principle or commitment, may serve as a "menu" which can be used by extension workers when discussing alternative approaches with shrimp farmers or would-be shrimp farmers. They may be used as an input to other environmental management initiatives (see below). Such a set might also be used as the benchmark for EIA as described above.

What is their relationship with other environmental management initiatives?

Compliance with environmental management standards and ISO standards is becoming increasingly common in many industries. These standards do not usually require adherence to specific practices, and are less prescriptive than GMPs. Typically they require members to demonstrate that they have established environmental management policy, procedures, monitoring, reporting and auditing systems. In some cases they are required to demonstrate steadily improved performance against their own environmental objectives. A code of practice, or a

set of desirable GMPs, may be used as part basis for developing a specific environmental management policy and plan, and may therefore serve to strengthen EMS and ISO schemes.

Environmental management of shrimp farming may also be promoted through integrated coastal management plans, or aquatic resources development and management plans related to a specific area. GMPs and codes of practice may be developed as a key element in such schemes, or where GMPs already exist, as an input to be further developed and adapted in line with the objectives of the plan.

What benefits can they bring?

To the individual farmer compliance with well-formulated GMPs *should* lead to:

- More consistent and sustainable production (reduced mortality and disease incidence).
- More efficient production (in terms of lower input use and waste output per unit production).
- Less conflict with other farmers and resource users.
- Enhanced reputation.

and *may* lead to:

- Reduced cost.
- Higher value product.
- Increased access to sites, services, grants, infrastructure, markets.

To groups of farmers sharing land and/or aquatic resource, farmer, compliance with well-formulated GMPs *should* lead to:

- Improved water quality.
- More consistent and sustainable production (reduced mortality and disease incidence).
- Reduced conflict with other resource users.

To other resource users sharing land and/or aquatic resources, the compliance of shrimp farmers with well-formulated GMPs *should* ensure:

- Good water quality.
- Access to resources as required.
- Maintenance and conservation of valuable habitats, natural resources and ecosystems.

To local people generally, and to the nation as a whole the compliance of shrimp farmers with well formulated GMPs *should* ensure:

- A strong and stable or growing economy.
- Well paid and secure jobs.
- Long term opportunities in the provision of supplies and services.
- Significant and sustained foreign revenue earnings.
- Increased product value.

To the region or world, the compliance of shrimp farmers with well-formulated GMPs *should* ensure:

- Reduced risk of disease spread between countries.
- Reduced risk of damage related to the introduction of alien species or genetic material.
- Conservation of globally threatened species, habitats, and ecosystem functions.

In practice the adoption of GMPs at farm level alone may not be enough to deliver the potential benefits listed above. External or uncontrollable factors such as availability of good quality feeds and postlarvae, new challenges to shrimp health and changing market conditions could interfere and prevent the benefits from being realized. This wider context should always be borne in mind when developing GMPs, and where necessary they should be supplemented by other sector management initiatives to ensure that all the stakeholders effectively capture potential benefits.

Constraints to effective compliance

Knowledge and understanding of natural resources, and resource functions and values, will be essential for rational and effective compliance with GMPs. Unquestioning compliance with codes as "operational rules" may yield temporary benefits, but will not promote the more subtle objectives of sustainable development.

Some desirable GMPs may require short-term investment to achieve longer term goals, or may require investment by an individual farmer for the good of a group of farmers and/or society at large. The extent of compliance will depend upon the differential between the benefits that the individual farmer can capture and the costs of implementing a GMP or set of GMPs.

Capturing benefits from compliance with some GMPs (such as those designed to improve water quality and reduce disease incidence) will depend upon compliance by all farmers utilizing a specific aquatic system. In many situations this will not be easy to achieve, and the incentive will therefore be weak unless universal compliance can be guaranteed. This problem will be compounded where water quality (for example) is significantly affected by other water resource users, such as processing or manufacturing plants, or intensive agriculture. Without corresponding initiatives across all resource users, there will be little incentive for action.

Many of the benefits to be derived from adopting GMPs can only be realized through effective organization, co-ordination of good practice, and direct access to markets where producer image and environmental/social issues are high on the consumer agenda. This explains why the main private sector driven initiatives (GAA code; organic certification) have come from large-scale producers and processors in the Americas. Such initiatives are less likely in Asian developing countries where the dominant producers are mostly small farmers, who are relatively poorly organized.

Possible negative impacts

Increasing international environmental and social awareness, coupled with the availability of certified products from well organized large scale producers, may force the price down of non-certified products. It will be more difficult for small-scale producers in developing countries to comply with codes of conduct and practice and they may therefore suffer a price drop. They may lack the necessary awareness, organization, reporting and marketing skills to participate in certification and labeling schemes. Great efforts will be required to enhance organization and co-ordination of small-scale producers if they are to compete. Having said that, the price differential itself will prove to be a major incentive to farmers to move towards more professional association and the implementation of GMPs.

Where no price differential exists, and where the costs of compliance add to, rather than reduce, costs, there is a danger that the market may be distorted so that compliance effectively carries a penalty. To avoid this, it is important that the mechanism of implementation of GMPs be structured to provide some tangible benefit to the producer.

If codes of practice are over-prescribed, in the sense that they promote a specific technical solution rather than promote a variety of solutions to achieve a specific outcome, then they will restrict innovation and discriminate unnecessarily against some producers. This is particularly the case for small-scale farmers where a particular GMP may have been handed down based on a highly technological approach. It is essential therefore that codes of practice are flexible and adaptable, while strongly promoting the sustainability objectives set down above.

Guidelines for development of GMPs

Key issues and guiding principles
Taking into account the uses, potential benefits, and possible constraints to compliance, the following are the guiding principles for the development and implementation of situation specific GMPs:

- They should allow for, and indeed promote, alternative technical/management solutions to meet sustainability objectives and deliver desirable outcomes;
- GMPs should be developed in line with priorities, capabilities and resources;
- They should be developed as part of a broader and more integrated planning process which addresses the issues of cumulative development and environmental capacity;
- Desirable outcomes must be clearly specified and measurable;

- A key element relating to all GMPs should be reporting of the implementation of the GMP and monitoring, reporting against intended outcome, and adaptation of GMPs as required;
- Baseline data and a framework for environmental monitoring will be required if the effectiveness of GMPs in delivering environmental benefits is to be assessed;
- Shrimp farmers should contribute to environmental monitoring and reporting costs in proportion to the damage they (may cause);
- GMPs should be reviewed regularly and modified/adapted as appropriate;
- GMPs should be developed and agreed through consultation with relevant stakeholders;
- Where a significant cost is associated with compliance/implementation, either very strong incentive or very strong regulation will be required, especially for small-scale producers;
- Organization and group compliance is a pre-requisite for effective implementation of GMPs whose objective is enhanced quality of common resources. In the absence of group compliance, there will be no incentive (and possibly a disincentive) for individual compliance;
- GMPs should be considered as only one element in a broad environmental management plan for the shrimp culture sector, preferably developed at local (provincial/district) level; and
- Adaptation of GMPs should be promoted through provision of relevant information appropriate to different scales and intensity.

Process for Site Specific GMPs

The steps involved in developing a set of GMPs are relatively straightforward and follow the same process as for any systematic problem solving process.

1. Problem identification

The particular problem or issue to be addressed by the GMPs needs to be identified. The identification process should be consultative and would involve not only farmers but other stakeholders.

2. Identify level of approach

The appropriate level at which to approach the problem needs to be addressed (i.e. farm level, sector level, national level, international level)

3. Identify impact required

The required impact should be identified (i.e. the outcome). Where possible this should be measurable (preferably quantifiably although this may not always be possible)

4. Consultation

If at sector level, a further process of consultation should be considered to ensure that all are agreed on the desired impact and the measurement of the impact of the GMP

5. Decide what options are available to meet the objective

Will the outcome require a single GMP or a system of GMPs? How have the same or similar problems been approached in other situations (e.g. agriculture, water treatment, soil engineering). Are they appropriate for use in the aquaculture context?

6. Identify resource requirement

Will the selected option require specific resources or expertise? Where is this expertise available? Can it be accessed?

7. Assessment of identified GMPs

Of the GMPs identified, which are likely to be most effective in view of the available resources? Which are achievable and is there a need to prioritize? If the BMP is not a practical option, what are the best alternatives?

8. Consultation

Another round of consultation of the GMPs identified needs to take place before a decision is made on the GMPs to be adopted and the implementation strategy

9. Decide on good management practice(s) to be adopted and implemented

10. Finalize the implementation strategy

Initiation and participation

There are no rules as to who initiates. GMPs and codes of practice may be initiated and driven by:

- Governments (wishing to demonstrate compliance with international agreements).
- Individual farmers or groups of farmers (wishing to demonstrate responsibility and enhance reputation).
- Local and international NGOs (wishing to promote specific social and/or environmental interests).
- Other resource users (wishing to change or modify shrimp farming activities which may be detrimental to their interests).
- International agencies (wishing to promote specific values, raise awareness; wishing to promote a level playing field).
- Processors and retailers (wishing to enhance the value and/or consumption of their products).
- Academics and technical specialists with a professional interest in promoting sustainable shrimp culture.

The fact that all these stakeholders are currently interested in GMPs and codes of practice implies significant momentum for the idea. It also means that whoever initiates the development of locally specific GMPs should be able to co-ordinate and balance the various interests, and gain broad support and agreement. Who is best placed to do this will vary from country to country.

Whoever initiates the process, the participation of all the stakeholders, and crucially, *effective and full participation of the shrimp farmers* themselves, will be essential if there is to be any sense of ownership, responsibility and chance of implementation.

The words *effective and full* are important, especially in developing countries and in the case of large numbers of small farms. Approaches involving the imposition of GMPs in this situation are unlikely to succeed and may simply result in farmers actively seeking ways to avoid compliance. The involvement of a few major producers is unlikely to provide the majority of small farmers with a sense of ownership and responsibility unless they are seen as opinion leaders or innovators in the private sector. A first step in developing local GMPs may indeed be to promote improved organization and representation of small farmers, so that they can take a full and effective part in developing GMPs. Also, group compliance – required to achieve some of the common benefits (improved water quality, reduced pathogens) -is much more likely where there is effective farmer organization and communication.

In all cases, the participation of major buyers and retailers is also important. Buyers will have a good grasp of consumer demands, and a better idea of the possible value of different GMPs in the market place – which is where some of the benefits will be realized. Similarly, involving major suppliers of goods and services to farmers will also ultimately benefit the process through improving their awareness and ultimately the goods and services they supply.

The rationale for some GMPs is to take account of the interests of other resource users. Clearly then, they should be involved from the start,

Issues identification

Once there is adequate commitment on the part of the main stakeholders to identify GMPs and to find ways of implementing them, there needs to begin a rigorous process of issues (problems, constraints, solutions, opportunities) identification. It is probable that most issues will fall within the framework of sustainable development objectives or the list of social and environmental problems associated with shrimp farming. These may be used as check-lists – but they should not be considered exhaustive: all local social and environmental issues associated with shrimp farm development should be identified and characterized, in terms of their immediate and secondary causes. In this regard the interactions between the local environment (its values and functions), local resource users, and shrimp farming location, technology and management will need to be explored in detail. This will provide the first insights into the kinds of GMP that might be required.

This process of issues identification will be mainly one of meetings, possibly supplemented by some research based mainly on existing information. Where farmers and other affected resource users are small scale and poorly organized, with limited access to information, there may need to be a significant participatory rural appraisal (PRA) process. This should serve to:

- Stimulate involvement and awareness.
- Develop a better understanding of the farming systems.
- Develop a better understanding of the social and environmental issues associated with shrimp farming.
- Identify practical, appropriate and realistic GMPs.
- Identify (practical, social, institutional, economic) constraints to implementation.

Important tools which can help in issues identification include matrices (e.g. sustainability objectives X farming practices); ranking exercises (using the output from the matrices to determine relative importance of the issue/problem/opportunity. These techniques not only aid issues identification, they also provide a clear framework for their subsequent communication, presentation, and further discussion.

Maximum stakeholder involvement should continue through the stages described below. This process will be more difficult, and requires greater resources where farmers are poor, poorly organized and widely dispersed. It is very unlikely that small farmer interests will be adequately represented at a few central meetings. A regular series of field workshops and structured farmer meetings in key locations and over an extended period will normally be required. It is also likely that practical demonstrations of the benefits of the GMPs will need to be undertaken, preferably on a key opinion leader's own farm.

Establishing agreement on how GMPs will be used

Having identified the issues, the possible means of addressing them should become clearer. GMPs (arising from the solutions and opportunities) can be developed and used in a variety of ways:

i. A package or menu of "good management practices" which can be used in extension and awareness raising, and ultimately to increase income;
ii. Components in codes of practice adopted by industry associations;
iii. Components in codes of practice for product certification and labeling;
iv. Components in environmental management schemes;
v. Individual or collective conditions in licensing and permitting procedures;
vi. Elements in specific regulatory procedures;
vii. Assessment criteria for EIAs;
viii. Components of comprehensive management plans with corresponding packages of incentives and constraints; and
ix. As a basis for investment or purchase screens.

The first four are all essentially voluntary approaches, which promote self-regulation of the private sector. Agreement to i above should be almost universal. Agreement to ii and possibly iii above is likely to be favored in those situations where shrimp culture is highly organized and managed (typically large scale producers/developed country producers). Agreement to iv above would allow shrimp farmers easier access to the benefits associated with various international environmental management standards.

Points v to vii above imply some level of enforcement by the Governments. This will generally not be welcomed by well-organized industry associations. Indeed the possibility of this route being taken may stimulate industry organizations to initiate their own self-regulation initiative. These approaches may however be necessary where the shrimp farming sector is poorly organized, where social and environmental issues have become critical, and where self-regulation has failed or proven inadequate, or where there is no obvious mechanism for self-regulation.

Point viii above is an intermediate solution for situations where the existing capacity for self-regulation and environmental management is limited, and where environmental and social issues are less pressing. In these situations a more comprehensive environmental planning and management process may be initiated. This will take significant time and resources, but should eventually deliver a package of incentives and constraints, and develop capacity, to meet agreed social, economic and environmental objectives in relation to specific aquatic resources systems. GMPs would form a part of this package, and incentives or constraints to maximize compliance would be developed and agreed.

Point ix above is receiving increasing interest.

Allocating responsibility
At this point agreement on the mechanism for developing and implementing GMPs should be reached. Agreement would be required for example in respect of:

- Who will co-ordinate the process and how.
- What methodology will be used.
- The drafting process.
- The implementing process.
- Monitoring, evaluation, and mechanisms for change/adjustment.

In all cases specific responsibility for key tasks should be assigned, and a schedule of activities drawn up.

In practice, and especially in developing countries, the role of government is crucial in co-ordinating initiatives related to GMPs with other environmental management initiatives.

Refining objectives and operating principles
On the basis of a full understanding of local farming systems and the social and environmental context, it should be possible to prioritize and supplement the objectives and the operating principles according to local problems and values and the agreed purpose and use of GMPs.

Broad consensus and agreement should be developed in relation to these objectives and principles, to be certain that stakeholders "buy in" to the rationale and make a commitment in principle. This should reduce argument and conflict over the need for particular GMPs, and should maximize awareness, responsibility, and the likelihood of implementation. The criteria associated with each operating principle (see other working paper – Annex C) should also be discussed critically and agreed.

Drafting specific GMPs
The foregoing process will have set the scene for proposing and exchanging ideas on specific locally appropriate GMPs that meet the requirements of the (agreed) operating principles. These GMPs may be based on existing practice, new practices, or practices known from elsewhere.

There are two main approaches to specifying GMPs. One approach critically appraises existing or possible *specific farm practices* in terms of their compatibility with operational guidelines, and their ability to promote sustainability objectives. The other focuses on individual farm or sector level[2] outcomes, and specifies, in more general terms, the kind of practice that would best deliver these outcomes. Clearly the latter is a more flexible approach, which allows for, and indeed stimulates, innovation. It focuses on what is to be achieved rather than how to get there. However, effective implementation will require sophisticated monitoring of impact/outcomes, rather than simple checking or reporting of practice. There are two problems associated with monitoring outcomes rather than practice. There may be many other factors affecting the outcome criteria, and the measurement of the outcome criteria might be expensive. Overall the strengths and weaknesses of these approaches will depend on the local situation (e.g. the immediacy of the problems; the capacity and organization of the farmers; the nature of compliance mechanisms) and in particular how immediate, critical and obvious the problems and solutions are.

Whichever approach is used, a proposed GMP or related set of GMPs should be assessed systematically:

- How effectively does it meet the requirements of the operating principles?
- Can its contribution to the objectives be measured (in theory and in practice)?
- Is it clearly superior to existing standard practice?
- Is it universally practical from a management perspective?
- Does it depend on other management practices for its success?
- Does it depend on particular conditions for its success?
- Does it imply additional cost?
- Will it yield economic benefits – and to whom?

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[2] Throughout this document, *sector level* typically refers to all the farmers operating within an identified aquatic system, such as an estuary, bay, lagoon.

It may be appropriate to grade practices as base, standard and best[3]. This assessment should ideally be undertaken with maximum involvement of stakeholders – using for example matrix discussion and presentation at field workshops and working meetings.

Sector management needs
Many of the objectives and operating principles require collective action or sector level management to address common resource issues (e.g. biodiversity conservation; staying within environmental capacity; minimizing disease). These are often the most difficult to implement – but in terms of overall sustainability may be the most important[4].

The limitations of the evolving set of farm level GMPs should therefore be assessed to identify where and how they can be strengthened at the sector level, and what management practices, and associated management mechanisms (organization, co-ordination, information exchange, monitoring, reporting etc) are required to comply with the operating guidelines and address specific local problems. The setting of standards appropriate to particular aquatic systems and undertaking monitoring which is adequate but simple and cost effective will require particular attention.

In addition to these organizational and common resource issues, the need to link farm or farm group level initiatives with improved management practices in the input supply and market distribution chains will need careful attention. Low FCR depends partly on feed quality; low disease depends partly on seed quality; high farm gate value (especially if linked to management practices) depends upon efficiency, quality management, and traceable custody throughout the distribution, processing and marketing network. Without improvements across the board, GMPs will be more difficult to implement, and the benefits more difficult to capture.

Integrated resource management
Beyond the aquaculture sector level, the activities of other sectors and their impact on common resources will need to be examined. It is pointless – and indeed unfair -to develop GMPs in relation to water quality of shrimp farm effluents if the main impact on water quality comes from processing, manufacturing or agriculture. If this is the case, the development of GMPs and common standards and monitoring requirements for all these activities should be initiated and co-ordinated – usually by the Governments.

Funding the process
The shrimp farming sector itself increasingly bears the costs of developing and implementing standards. This has already happened for salmon, and for shrimp in the case of the Global Aquaculture Alliance initiative. The latter was driven by a few well organized large-scale producers or processors, well placed to recoup their investment in the long term. Yet again, raising the funds, and recouping the investment will be more difficult and risky for small scale and poorly organized farmers. A significant organizing and funding role for government and/or aid agencies will therefore be required in many developing country situations.

There is potential for raising taxes that might be used for environmental management. These may include taxes on exports or feeds for example. It is important however that such taxes are allocated to the needs of shrimp farming.

In many cases better organization of existing resources (such as government fisheries officers) may be necessary or reduce costs.

Implementing GMPs

There has been considerable work carried out on preparation of codes, BMPs and GMPs, but so far little experience on their implementation, particularly on small-scale farms. Compliance will arise from a combination of awareness, knowledge, a sense of responsibility and incentives (related to financial return, peer pressure, government persuasion and market demand). The requirement for a nature of incentives will vary greatly according to circumstances.

Analysis of costs and benefits
Understanding the nature and distribution of costs and benefits arising from the implementation of specific GMPs will be essential for assessing the desirability of a particular GMP and the need or otherwise for compliance incentives. Ideally the following should be assessed:

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[3] See British Columbia Salmon Farmers Code.
[4] See for example the experiences from Sri Lanka (Siriwardena, 2000).

- The marginal costs and benefits to the individual farmer.
- The marginal costs and benefits to all the farmers within an aquatic system.
- The costs and benefits to wider economy/society.

In practice it will be relatively easy to estimate the costs, but more difficult to estimate benefits associated with a particular GMP or set of GMPs, especially as we move up from individual farmers to society at large. This immediately signals a problem: to many small-scale farmers the costs will be more obvious than the benefits, especially for some GMPs, and incentives/constraints will need to be devised. These may be market or government driven as discussed below.

In practice, for many GMPs, and for the purposes of taking the process forward, the priority will be to quantify the costs and benefits to the individual farmer with a view to assessing compliance needs. It should be possible to assess the costs associated with disease incidence with some accuracy; although the contribution of specific GMPs to reduced disease incidence (the benefits) will be harder to measure. However, "guesstimates" of the overall benefits of a suite of GMPs designed to reduce disease incidence should provide useful information. The costs and benefits associated with GMPs designed to conserve biodiversity will typically be more difficult to assess, and will have a significant subjective element.

A matrix of costs and benefits associated with different GMPs may be a useful way of organizing and presenting this information.

Compliance mechanisms

While some GMPs may be associated with reduced cost or increased production (in the long term) some will probably be associated with increased cost, and will not be adopted in the absence of some form of incentive. Depending on the way in which the GMPs are to be packaged and promoted, and taking into account constraints to compliance and in particular the nature of the costs and benefits, all possible opportunities for promoting compliance should be examined. These might include, for example:

- Demonstrating profitability of GMPs.
- Effective publicity, promotion, dissemination, awareness raising.
- Farmer organization; facilitating information exchange.
- Promoting private sector self regulation through the threat of government regulation.
- Establishing an industry or association compliance committee.
- Economic incentives such as taxes or fines associated with non-compliance.
- Incentives associated with compliance.
- Permits and licenses conditional on compliance.
- Audit, certification and environmental labeling schemes.
- Linking compliance with economic incentives (e.g. credit access).
- Regulation (enforcement and punishment).
- Supplier subsidy.
- Insurance and liability.
- Investment screens.
- Limited access to compensation in the absence of compliance.
- Joint liability (to deal with social/risk issues).

Different approaches may be needed for different GMPs or sets of GMPs depending on the distribution of costs and benefits to the farmer and society as a whole.

Incentives to promote compliance at provincial or national level in respect of sector level management practices should also be considered. For example, pressure may be exerted on governments at national or provincial level to develop strategies to address biodiversity conservation or environmental capacity issues. This pressure may derive from international commitments, negative publicity, and in extreme cases, trade embargoes on unsustainably farmed shrimp – and such embargoes typically impact all shrimp produced by a country.

It may be more difficult for different producers in different areas to meet standards. It is important that improvement rather than meeting absolute standards is used as a criterion for effective compliance. Stepped or graded standards may also be considered.

Awareness and knowledge

The process of developing GMPs described above will in itself make a substantial contribution to awareness raising and the exchange of knowledge and ideas. Once these are formulated and published they can be further used through formal and informal channels to raise awareness. This

argues strongly for well designed and presented GMPs. Crucially the rationale and the expected outcomes associated with specific GMPs must be clearly communicated.

Organization and ownership: promoting responsibility and developing capacity
Stakeholder involvement as described above, coupled with increased awareness, should promote increased responsibility. A sense of "ownership" of the GMPs or the package will promote interest and enhance compliance. A financial return will guarantee it.

"Ownership" of the resources affected by shrimp farm activity is also important. If a single large farm dominates (and in some cases legally owns) an aquatic system, it will be clearly in its interests to maintain water quality within that system. If many small independent farmers operate within such a system, individually they will have very little influence on the quality of that system, and their interest and commitment will be correspondingly more limited. If other resource users also have a significant impact on the system (e.g. processing plants etc) their interest will be further diminished. Association and organization is the only practical means to gain greater control and therefore responsibility.

Farmer organization, and in some cases government intervention will be essential requirements to address this problem. In Sri Lanka, emphasis is being place on the need for promoting the cluster concept – organizing small farms into groups with a common interest (Siriwardena, 2000). Several possible routes are suggested for this, ranging from registered associations, through the "nucleus estate" type model, to contract farming. In all these cases, great care is required to ensure that the interests of individual farmers coincide with the interests of the association, the "mother farm" or the contractor. Many of these models have failed in the past because of conflicting interests.

Farmer organization will probably also be a key element in enabling compliance in terms of reporting on outcomes related to common resources and capturing the possible benefits from environmental labeling schemes. Such organizations will themselves come up against issues of ensuring compliance among their members.

Building on supply and purchasing networks
Large numbers of small farmers are influenced very effectively by good marketing efforts. Suppliers of feeds, chemicals and other products do manage to both reach large numbers of small-scale farmers and influence their behavior. In Thailand, for example, the speed with which certain farm practices become adopted can be quite impressive. Also, the influence of the market itself can be an important factor for change. Witness the dramatic reduction in antibiotic usage in the early 1990s in Thailand when exporters started to reject tainted shrimp.

The threat of regulation
The threat of government restriction and regulation has been used to stimulate self regulation of many industries world-wide, and has often been highly effective.

Establishing an industry or association compliance committee
The British Columbia Salmon Farmers Association has adopted its own code of practice that applies to all its members (probably anticipating government regulation or consumer backlash). Compliance is enforced primarily through comprehensive reporting systems and public complaints, which are channeled to a compliance committee, which includes both members of the association and "public interest bodies" (2 members).

Economic incentives
A wide range of economic instruments has been proposed to encourage compliance with socially and environmentally desirable practices. These include, for example, taxes on polluting inputs or outputs; fines related to breaches of specific standards; subsidies related to siting, design, technology etc , and sale or allocation of environmental goods and services, such as high quality water, or environmental capacity. Ideally any tax or fining system should be balanced by a subsidy so that there is no net loss to the sector as a whole – unless its activities amount to a cost on other economic activities.

Permits and licences conditional on compliance
Perhaps the easiest approach to enforcing compliance is to have a permit or licensing system for shrimp culture, and to make issue of a permit conditional on adherence to a code or set of core GMPs. Clearly this requires substantial agreement on the code and GMPs as well as some form of auditing to report on compliance. Auditing in turn will be far easier if effective reporting procedures are in place (as set down in the operating principles).

Farm gate value
The most effective incentive to compliance will always be farm gate value. Linking higher farm gate value with compliance to GMPs will depend upon product identification and tracking through the supply chain, coupled with a "willingness to pay a premium" on the part of identified wholesalers, retailers and consumers. This will require that either:

- Auctions sort, identify and sell product according to quality and sustainable production criteria; or
- Farmers or groups of farmers sell significant quantities of product through direct channels in compliance with buyer requirements related to consumer preference.

Participation of small farmers in environmental labeling initiatives will require significant organization – to guarantee that GMPs related to common resource management are effectively implemented; to generate adequate scale of production so that the costs of auditing, certification, product tracking and identification etc can be minimized; and to liaise with buyers to define production practices that can be linked to a market premium. Government and/or aid projects may need to intervene to facilitate this process.

Alternatively, a buyer may contract a small farmer, or a group of small farmers, to produce a product in compliance with buyer specifications, and might facilitate such compliance in various ways. Increasingly, buyers are becoming interested in the source of shrimp they purchase and the means by which they are produced. It would be of significant benefit to the adoption of GMPs if they could be used as a means to extend the value chain from producer through to the consumer (the "pond to plate" concept).

Where labeling schemes are being considered, potential buyers might become closely involved in the drafting of the code of practice and individual GMPs. The role of third parties in verification or certification of such labeling schemes also may need to be explored.

Monitoring, evaluation and adaptation

Monitoring impact
The impact of a GMP or a set of GMPs in terms of moving towards a sustainability objective can be measured in different ways at different levels:

- Measuring and monitoring impact at the farm level.
- Measuring and monitoring the rate of compliance in a group of farms.
- Measuring and monitoring impact at sector level.
- Evaluating overall achievement/effectiveness against sustainability objectives.
- Assessing the distribution of costs and benefits associated with the introduction of GMPs .

Ideally a comprehensive programme should be undertaken (by the implementing group) to address monitoring at all these levels. Again, effective record keeping and reporting (which should figure strongly in GMPs themselves) coupled with some way of synthesizing these reports in a cost effective way are essential conditions for long terms success.

Adapting/refining/supplementing GMPs
The technology associated with shrimp farming, and the conditions under which it is undertaken are changing rapidly. GMPs – especially those which are relatively prescriptive – will need regular review and adaptation, based on effective monitoring.

Environmental values will also change, especially in relation to the shifting pattern and abundance of coastal resources, and this again will have implications for the nature of GMPs.

Changes in market dynamics will also inevitably require some adjustment of GMPs to maintain their cost-effectiveness.

The means of promoting compliance may need to be adjusted if it is found to be inadequate to meet objectives.

GMPs overall may be found to be wanting, and alternative approaches, based, for example, around integrated coastal management, or aquaculture development land, may be required to supplement GMPs more effectively.

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ANNEX E: ELEMENTS OF GOOD LEGAL AND INSTITUTIONAL ARRANGEMENTS FOR SUSTAINABLE DEVELOPMENT OF SHRIMP CULTURE

Objective of "Good Legal and Institutional Arrangements"

The overall objective of good legal and institutional arrangements is to ensure that shrimp culture is practised and developed in a sustainable manner maximizing its contribution to the realization of national economic, social and nutritional goals for current and future generations.

What are legal and institutional arrangements?

Good legal and institutional arrangements reduce uncertainty by encouraging sustainable shrimp culture and protecting interested parties against potential negative social, environmental or economic impacts of shrimp culture. There are three aspects of legal and institutional arrangements:

- ***The rules of the "game"*** (i.e. shrimp culture). These can be binding, such as legislation and contractual arrangements, or non-binding, such as codes of conduct and guidelines etc.;
- ***The interested parties (actors/players)***. These are individuals/organizations who are directly and indirectly affected by shrimp culture as well as those authorities, bodies and individuals that can influence the development of shrimp culture.
- ***The processes***. These are the processes to enhance co-operation between the interested parties, identify, establish and agree on rules, and seek rule adherence through voluntary compliance, economic and other incentives, and through punishment of rule breaches.

A good way to understand an institutional and legal arrangement is to use an analogy with a sport, such as football. The rules of football consist of formal written rules and, often, unwritten codes of conduct, which underlie and supplement these formal rules such as good sportsmanship. For the game to function smoothly, the rules have to be workable and the cost of discovering violations not prohibitive. This means the rules have to be acceptable, practical, adaptable and enforceable. Compliance can be either voluntary; or by direct enforcement by the recognized authority of a referee and, more remotely, by the decisions of national and international football associations. Furthermore, the punishment for violations of rules have to be both appropriate and proportional and include a system of increasing sanctions for repeated violations. Appropriateness and proportionality implies that the level of punishment varies according to the nature, gravity and recurrence of the violation.

Even with a recognized set of rules, the game will be different according to the types of players. The game will be different between amateurs and professionals who have more skills and knowledge, or between a team in its first game and a team in its 100th game. This is the same for shrimp culture. As farmers increase their skills and knowledge and/or gain more experience in shrimp culture, they are likely to be better farmers. In addition, the perceptions of common rules will be different according to national social and economic development contexts. For example, in some countries, a particular set of rules may be perceived as unreasonably idealistic or costly to enforce or comply with, whilst in other countries, the same rules will be seen as being too rudimentary.

Staying with the football analogy, the interested parties of the game include direct participants (the players), those who can affect the game (referees, football associations, sponsors), those who are directly affected by the game (spectators) and those who are indirectly affected (such as people living close to the football stadium). In shrimp culture, direct participants would include farmers and investors; those who can affect the development and conduct of shrimp culture would include governments, regulatory bodies, NGOs, consumers and other sectors such as tourism; and those who are affected by shrimp culture would include local communities, fishers and other water users.

The third aspect of institutional and legal arrangements is the development of processes to encourage interested parties to agree and co-operate to achieve a common goal, whilst recognizing their individual objectives, capabilities, capacities and the resources available to them. A critical component of this process is the mechanisms that encourage interested parties to develop strategies to comply with, rather than break, the rules. For example, in football, the common goal could be to ensure that the game is enjoyable for all interested parties, despite the fact that interested parties may have different objectives. Players want to win the game, sponsors want to sell products and spectators want to show support for their team. By understanding each others objectives and agreeing that they share a common goal but different interests in the game, the rules can be designed to accommodate and achieve the goal.

In shrimp culture, the common goal should be sustainable shrimp culture, although different interested parties may have different goals and have yet to agree this common goal. Farmers want to make a profit, local communities want to maintain their livelihoods, investors want to ensure loans are repaid, processors want a good quality product and governments want export earnings. Inevitably there will be some trade-offs, but processes which take into account different interests and enable interested parties to work together, are more likely to lead to acceptable and more resilient institutional and legal arrangements.

There is a close interrelationship between the three elements of institutional and legal arrangements. The types of interested parties that emerge from the establishment of shrimp culture and how they evolve are fundamentally influenced by rules and processes. In turn, interested parties influence how rules and processes evolve.

Legally binding and non-binding instruments

Although the terms "guidelines" and "code of practice" are widely used, in relation to a broad spectrum of activities, they are expressions which often conceal a high degree of ambiguity. Most fundamentally, a distinction must be drawn between a formal legal requirement and obligation that arises from any set of guidelines or code of conduct.

A legal requirement is mandatory in nature, so that the failure to adhere to it is, potentially, the subject of whatever legal consequences follow from the breach. Where a requirement is provided for in guidelines or a code of conduct, however, the consequences of failing to adhere to it are less clear. In some instances, guidelines overlap with strict legal requirements so that the consequences of breach will be difficult to distinguish from a breach of a strict legal requirement. In other instances, guidelines address matters which are not the subject of legal requirements and for which no specific legal penalty is provided. In such instances, there is a range of possible consequences that depend upon the status of the code, the body that has established it and the process that led to its elaboration.

In some instances adherence to guidelines may be supported by various non-mandatory mechanisms to encourage compliance. Education and training may be used to instill in those to whom the code is addressed an appreciation that compliance is in the best interests of those individuals and the industry of which they form a part. Economic and other kinds of incentive may also be used to provide important financial incentives for compliance. Possibly, shrimp farming associations may give their weight to the need for compliance with guidelines by the imposition of internal pressures, such as making compliance with guidelines a condition of membership of the association and receiving any commercial or other benefits which membership entails. In each instance, however, the distinction must be emphasized that guidelines are not normally supported by any formal legal sanction of the kind that is available where legislative requirements are involved.

The role of (legally) non-binding instruments

The lack of formal legal sanctions to support guidelines or codes of practice should not be regarded as a problem. Indeed, the economic pressures to adhere to a code of practice might be seen by many shrimp farmers as a greater reason for compliance than the possibility of a legal penalty that might accompany breach of a legislative requirement. Clearly guidelines have a valuable function, but it is a function that is important to distinguish from that provided by strict legal requirements.

Similarly in the description of key elements of institutional and legal arrangements that follow, it is hoped that the non-mandatory character of the regulatory practices that are proposed will not detract from their value as a guide to good institutional and legal practice. The objective has been to identify good institutional and legislative practice from amongst the countries that have been surveyed. Largely, therefore, the elements of institutional and legal arrangements that are discussed consist of a consolidation of examples of good practice distilled from the actual practice of jurisdictions where shrimp farming is presently undertaken. Whatever obligation attaches to adherence to these elements will derive from the emergence of a general consensus that they represent good institutional and legal practice for shrimp farming.

The approach

In relation to the following elements on institutional and legal arrangements, the principal addressees are the governments of those countries in which shrimp farming is undertaken. The enactment of legislation, policy-making and planning is usually a function of government, though some degree of devolution of legislative powers is found in many jurisdictions. Therefore, the responsibility for establishing a satisfactory institutional and legal framework for shrimp farming, and ensuring its proper administration, implementation and enforcement, rests largely with national governments.

The limitations of addressing common guidelines to different governments must also be acknowledged. The difficulty is that of formulating generally applicable guidelines for countries with shrimp farming industries in different stages of development. Guidelines which fail to take sufficient account of the national economic and developmental contexts in which shrimp farming is undertaken will be perceived to be unreasonably idealistic by some governments to which they are addressed and, at the same time, perhaps seen as too pedestrian by other governments. Because of these concerns, the elements described in this document have sought to strike a pragmatic balance between the possible extremes of institutional and legal arrangements.

Nonetheless, the need for specific guidelines for different developmental contexts is fully recognized. Finally, guidelines have a dynamic and progressive character so that, though they may represent good practice at the present time, the concept of 'good practice' evolves over time and will need to be superseded as actual practices improve.

Structure of this document

As already explained, institutional and arrangements are comprised of three components: rules, interested parties and processes. There is no hierarchy to these components; all are equally important and all interrelated. However, there is far less information available on interested parties and processes than on rules as witnessed by the survey on the national regulation of shrimp culture, conducted under the auspices of the FAO Legal Office. Experience suggests that the weakest components of institutional and legal arrangements in shrimp culture, have not been the rules *per se*, but the parties and processes supporting the development, implementation and enforcement of these rules. For this reason, the following document addresses generic elements concerning processes and parties first, and then addresses elements concerning rules.

Processes

An important component of any good legal and institutional arrangement (GLIA), is to ensure that there are adequate processes to encourage interested parties to agree and co-operate together to achieve common goals and realistic and acceptable rules as well as to develop strategies which comply with, rather than break, the rules. For shrimp culture, the critical processes are as follows.

Reviews

Good institutional and legal arrangements depend on existing laws, traditions, institutional and consultative structures. Therefore, before any changes are introduced to institutional and legal arrangements, it is necessary to first review the current situation. A legal review would look into legislation, codes of practice, policies and plans and any rule which may affect shrimp culture.

A review of the responsibilities, roles and structures of formal and informal institutions involved in shrimp culture is also essential. The review should include the identification of interested parties. Such a review will help in the selection or development of appropriate mechanisms and responsible authorities at various levels to co-ordinate and manage the sector and/or make recommendations to streamline and consolidate roles, responsibilities and structures of existing institutions.

The institutional and legal arrangements have to be reviewed periodically to allow for regular updating in the light of developments in the shrimp culture sector.

Deliberations

Consultation with, and among, interested parties makes it easier to develop more realistic and effective institutional and legal arrangements by bringing greater information and broader experiences into the process, embedding new initiatives into existing arrangements and by increasing an understanding of goals and aspirations of interested parties.

Decisions should be the outcome of a process that provides channels and consultative structures for representations to be made by the different individuals and interest groups involved and for these to be fully and fairly considered in the formulation of policy or the making of any particular rule or procedure.

The greatest possible degree of transparency in the operation of any institutional and legal arrangement is desirable, so that the responsible authority is required to make decisions against explicit criteria as to how competing demands for shared resources are to be reconciled against the needs of shrimp culture.

No particular consultative structure can be recommended. Different approaches may be used for different tasks and for different interested parties. However, it is highly desirable that mechanisms

are developed which include vulnerable groups and in order to overcome social norms undermining the participation of certain interested parties in the consultation process. Furthermore all participants in the consultative process should have realistic expectations of their roles and not be misled into believing that their role is more influential than it actually is, or vice versa.

Zonal planning
States should recognize the multiple use nature of coastal resources and the sensitivity of ecologically important habitats. Coastal zone planning is an important tool to identify and allocate areas permissible for aquaculture, including shrimp culture development.

The overall distribution of public and private rights to own and use coastal resources should be conducive to protecting the environmental quality and long-term sustainable development of coastal resources. An appropriate balance between shrimp culture concerns and public concerns, including the rights of local communities, should be reached in the allocation and use of land for shrimp culture purposes. Zoning for shrimp culture will contribute to the co-ordinated development of individual farms and be particularly beneficial for small scale shrimp farmers while reducing the negative impacts often associated with shrimp culture.

In carrying out zonal planning for shrimp culture development, States should take into account, amongst others, (a) carrying capacity of the ecosystem, (b) technical and environmental compatibility, (c) social and economic criteria, (d) the use of sea and freshwater (e) involvement of local communities and relevant interested parties, (f) integration into other forms of farming practices, (g) effluent and waste management, and (h) provision of appropriate infrastructure.

Environmental impact assessments
Many countries have introduced environmental impact assessment procedures in relation to shrimp culture. There are many differences concerning the stage at which the EIA is required as well as the contents of the EIA procedure. Ideally, the EIA should occur as early as possible in the process of analyzing a proposed project or programme. EIAs should contemplate cumulative and long term social and health risks and impacts; large-scale effects; design, location and technological alternatives to the proposal being assessed and sustainability considerations including resource productivity, assimilative capacity and biological diversity.

Economic incentives for compliance
Weak enforcement mechanisms often do not encourage compliance. Inadequate penalties do not function as a sufficient deterrent. It is particularly important to develop economic incentives to increase the net benefits to farmers and to make compliance with the rules more attractive than breaking the rules. These incentives may include taxes on unsustainable practices and eco-labelling. To secure compliance, economic incentives must be cost-effective to administer.

Extension and training
Training, education, awareness creating programmes and use of extension to support institutional and legal arrangements are extremely important. This should include information dissemination on current and proposed rules and compliance mechanisms. States should pay special attention to small scale farmers and help them in improving their culture practices through the provision of extension services and training.

Training and education programmes should also include training interested parties in their role in the consultative process.

Consideration needs to be given to whether provision of training programmes and extension services are a legal obligation upon States, or whether they can be voluntarily provided, for example, by producers' associations.

Research
To improve the knowledge base for sustainable shrimp culture, appropriate research is encouraged on topics such as the carrying capacity of coastal ecosystems and improved management practices.

Financial arrangements
Sustainable shrimp culture is a means of achieving such national goals as food production, employment and foreign exchange earnings. To achieve these goals appropriate financial mechanisms should be made available.

Information collection and dissemination
There should be a general obligation upon States to secure free access to all publicly held information which is relevant to the development and conduct of shrimp culture.

Procedures should be implemented to enable regular collection and analysis of data from farmers and such information should, within the constraints of commercial confidentiality, be disseminated to interested parties.

States should develop and make information available on suitable site selection criteria for shrimp farming, and identify sites, locations and zones suitable for shrimp farm development.

Monitoring
To assure that shrimp culture development and management are proceeding in a sustainable manner, impacts on environmental and social conditions potentially affected by the shrimp farming activity should be regularly monitored.

Research and environmental monitoring should be directed towards provision of improved information for the formulation and implementation of laws, regulations and effective codes of conduct for the development and management of shrimp culture.

Enforcement
Acknowledging the importance of ensuring compliance with the regulatory framework governing shrimp culture, various mechanisms of enforcement should be taken into consideration. These mechanisms may include administrative sanctions, social sanctions, mediation and arbitration and traditional community dispute resolution.

Shrimp culture legislation requires adequate mechanisms for enforcement. Moreover, given the specialized nature of shrimp culture, and the corresponding level of technical expertise that must be possessed by regulators, the cost of enforcement might be considerable. States should recognize, however, the potential environmental, economic and social cost of not enforcing relevant legislation.

Analyzing the areas where there are the greatest risks of non-compliance and where an improvement in compliance will have the greatest impacts, will contribute to more effective use of compliance resources.

A key goal of regulatory enforcement should be transparency. Enforcement institutions should provide information as to the staffing and resources available for enforcement purposes, and uses that will be made of discretion in exercising regulatory powers, such as the circumstances in which prosecutions will be initiated. Public reports should be periodically provided by enforcement institutions that document the manner in which regulatory powers have been exercised and including details and results of specific legal proceedings.

Interested parties

Interested parties include direct participants in shrimp culture, those who can influence the development and conduct of shrimp culture and, those who are affected by shrimp culture.

Identification of interested parties
It is necessary to identify interested parties in order to include them in the consultative process and to determine who will be positively or negatively affected by changes in the institutional and legal arrangements.

Objective and transparent criteria for defining interested parties should be developed and regularly reviewed so that parties are clear as to who should be involved in the consultation process.

Allocation of institutional responsibilities
Institutional responsibilities for shrimp culture need to be defined in legislation so that rights and duties relating to policy formulation and implementation, economic incentives, law enforcement, product quality control and the provision of support services concerning research, education and training are allocated to appropriate bodies.

There should be a clear allocation of institutional responsibilities for policy, legislation, enforcement and plan formulation and implementation, which are aligned with existing institutional capacities and resources and minimize overlapping and conflicting responsibilities. Where possible, an overall responsible lead authority for coastal aquaculture, where appropriate for shrimp culture, should be established.

Given that several licences, permits or other authorizations are typically required from different government institutions, a lead authority should be identified in order to streamline and co-ordinate the authorization process for establishing a shrimp farm as well as to monitor and control compliance with the respective terms and conditions attached to such licenses, permits or other authorizations.

Specialist bodies

Insofar as shrimp culture is the subject of specific legislation, that legislation must be implemented and enforced by authorities which are staffed by a sufficient number of appropriately qualified staff and provided with adequate resources to ensure that the legislation is effectively and efficiently enforced.

Considering the importance of collective action in sustainable development, shrimp farmer groups and associations should be encouraged.

It is in the interests of farmers operating within a particular aquatic system to form representative bodies or associations to co-operate in the environmental management of that system. This could include regular reporting of environmental and socio-economic conditions as well as the establishment of a fund for environmental restoration and maintenance.

Rules for shrimp culture

Basic principles: legislation

The most important controls upon shrimp culture should be provided in legislation which should be focused on shrimp culture activities and coastal aquaculture. The enactment of shrimp culture legislation without providing adequate mechanism for law enforcement is not satisfactory. An appropriate balance between mandatory measures and other obligations and incentives for securing compliance should be sought.

The enactment of activity-specific legislation should not preclude shrimp culture from being governed by additional legislation relating to matters such as land use, environmental and ecological quality, and public health and food safety where these are satisfactorily provided for within more general regulatory regimes.

The enactment of legislation concerning shrimp culture should not preclude the use of non-mandatory mechanisms for the encouragement of increasingly higher standards of performance in all aspects of the industry. The use of informal or incentive-based measures for the improvement of standards should be encouraged and supported by whatever means are appropriate but should not be seen as a substitute for legislation on matters of paramount concern to the sustainable development of the industry.

The costs of over-regulation and excessive administrative burdens on shrimp farmers should be recognized. Shrimp farmers can become overburdened by mandatory legal requirements which are inappropriate or disproportionate in relation to their objectives. These can obstruct effective enforcement and increase the potential for corrupt practices. In a situation where mandatory and non-mandatory mechanisms are likely to be equally effective as means of securing a desired improvement, the least coercive mechanism is preferred.

It should be recognized that over-regulation also leads to an increasing bureaucratic burden on administrators and which increases the cost of administration and the potential for corrupt practices.

The application of 'sustainable development' to shrimp culture should be explicitly interpreted nationally, and sometimes in relation to local circumstances. Where appropriate, the need for sustainable development should be explicitly incorporated in legislation governing shrimp culture. In addition, performance indicators (particularly for sustainability) to measure achievement of policy and legislative objectives should be identified.

Relevant interested parties should take management decisions for shrimp culture based on the best scientific evidence available, also taking into account traditional knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors. Where current knowledge is insufficient, for example in respect to environmental carrying capacity, the precautionary approach should be adopted.

Protection of shrimp farming from other activities
Shrimp culture is completely dependent upon good water quality and therefore vulnerable to contamination from industrial, agricultural and other effluent sources. Pollution of water supplies will impact shrimp health or cause contamination to shrimp stocks, with consequent food safety implications.

Shrimp farms are therefore entitled to regulatory protection against pollution. Discharge licencing requirements should be applied to all significant dischargers of harmful effluents so that the quality of water is maintained at a level which ensures that there are no harmful effects upon shrimp farms in the vicinity. Where effluent quality parameters governing harmful discharges are exceeded, environmental regulatory authorities should pursue legal proceedings and, where provided for, seek compensation from dischargers for any damage caused to shrimp farms.

Basic principles: Codes of practice
Voluntary codes of conduct, codes of practice and guidelines can be extremely useful, and States should encourage and participate in their development.

Codes of practice addressed to shrimp farmers perform an important role in identifying good practices and encouraging adherence to their principles whilst avoiding the potential adverse effects of unnecessary legal formality, and reducing regulatory costs. Codes are a means for promoting efficiency, providing protection and assurance to consumers and producers, and helping to achieve sustainable shrimp culture operations. Nonetheless, to be effective, a code of practice has to have a widely recognized status. This is usually acquired by its promulgation by a body that is acknowledged to have recognized technical expertise and the capacity to formulate principles of conduct which are generally endorsed as being in the best interests of the industry and its participants.

Codes can be developed at local, national, sub-regional, regional and international level as well as for various sectors - production, processing, suppliers, importers - wherever there is a cohesive unit of participants.

Associations of those involved in shrimp culture have an important collective interest in the quality of the product that they produce and the enhancement of the public perception of the industry as being committed to achieve high environmental and social standards. Hence, where a shrimp culture association exists, it should work towards performing an important educational and quality enhancement role and influencing its members to maintain the highest possible standards. Accordingly a shrimp culture association should establish a code of practice and exert its influence over its members to encourage adherence to that code.

In some cases, the government is best placed to produce and disseminate a code of practice on shrimp culture and should in every case give careful consideration to the benefits which may be secured by the establishment of an appropriate code to encourage standards to be raised beyond the minimum required by regulatory provisions.

Whether a code of practice is formulated by a government department or a shrimp farming association, it must be recognized that promulgation of a code carries a continuing commitment upon the part of that department or association to use all reasonable means to ensure that the code is fully and effectively implemented.

Land tenure arrangements
States and governments should recognize that a shrimp farmer is a legitimate user of coastal resources. Relevant legislation should provide for clearly defined and legally enforceable land use rights for shrimp farmers. Land use rights should allow the shrimp farmer to conduct his/her activities in a responsible manner and contribute to the achievement of good shrimp culture management practices.

There needs to be an effective mechanism to ensure that the use of land does not detract from public interests in the protection of the environment and ecosystems, and that there is no unacceptable intrusion upon the rights of others to make use of land or water.

In allocating land use rights for shrimp culture, States should also protect the rights of traditional local communities. Where and when necessary, mechanisms should be put in place for settling conflicts between shrimp farmers and traditional local communities of a coastal area and for compensating them, as appropriate, for any damage the development of shrimp culture might create to them.

Where land which is to be used for shrimp culture is within the public domain, there needs to be a mechanism for ensuring that shrimp culture is appropriately undertaken at the proposed location and that the authorization to conduct shrimp culture at that location is subject to whatever conditions are necessary to ensure the protection of public interests.

Where government financial support is provided for the acquisition of land-use rights for the purposes of shrimp culture, appropriate environmental, ecological and other public-interest conditions should be imposed, along with effective mechanisms to ensure continuing compliance with such conditions.

The authorities responsible respectively for the allocation of land-use rights and for aquaculture in a coastal area should closely collaborate and consult with each other to ensure that the development of shrimp culture activities takes place in the light of the local, regional and national policy objectives for the development of shrimp culture and the management of the coastal zone.

Shrimp culture development license

A shrimp culture development licence should be established to enable the commencement of shrimp culture operations, whether on public or private land. The shrimp culture development licence should require prospective shrimp farmers to prevent the potential adverse environmental, ecological and social impacts of his/her activity.

In particular, the authority responsible for granting the shrimp culture development licence should have the powers to consider a license application in the context of :

- local, regional and national policy objectives for the development of shrimp culture and the management of the coastal zone;
- the particular environmental, ecological and cultural characteristics of the locality in which an installation is proposed;
- the representations of relevant interest groups, and members of the public generally, as to the beneficial or adverse impacts of the proposal; and
- the need for environmental assessment to ascertain the likely impact of the venture upon the local environment and ecosystem.

Where an environmental assessment is a mandatory requirement for obtaining an aquaculture development licence, the circumstances in which such assessment is required should be clearly spelled out either in the law or in another formal instrument and take place preferably before the acquisition of land use rights.

Where potential adverse impacts cannot be satisfactorily accommodated by the imposition of appropriate conditions, the shrimp culture development licence should be used to prevent the commencement of shrimp culture activities in unsuitable locations or to prevent the establishment of an excessive concentration of farms in particular areas.

Where a shrimp culture development licence is required for a specified kind or size of shrimp farm, or a shrimp farm in a particular area, commencement of shrimp culture in breach of licence should be subject to a penalty. As appropriate, powers to remove an unlawfully established shrimp farm and to restore the site to its former condition.

Continuing controls upon shrimp culture activities

Although shrimp culture development licence is an effective means of regulating the initial establishment of shrimp farms, it is not always a sufficient means of controlling the various continuing activities that take place at shrimp farms.

Accordingly, there are a range of further licences, permits or other authorizations which may need to be imposed to address the day-to-day activities which are capable of giving rise to environmental, ecological and social concerns. These are considered in more detail in the subsequent sections. Where possible, States should consider incorporating these various authorizations into a unique set of terms and conditions attached to the aquaculture development licence.

Where new legislation is being enacted, the interests of those persons engaged in shrimp culture should be carefully considered. Special transitional provisions may need to be provided for existing shrimp farms to allow them to comply with the new legal requirements.

Fresh water use
Given the increasing scarcity of freshwater resources, appropriate regulatory mechanisms should be put in place to ensure sustainable use of these resources.

Where competing demands for water supplies exist, these are most effectively addressed and reconciled by the use of a water licensing system which requires a shrimp farmer to obtain a licence for water use and not to exceed the authorized amount of use or to contravene any conditions to which water use is subject. As appropriate, a water licensing system may be combined with the pricing of water as appropriate.

Government and/or farmer associations, in collaboration with other water resource users, should agree on appropriate quality standards for open water and groundwater within a defined aquatic system used for shrimp culture, and develop an arrangement to maintain these standards.

Wastewater discharge licensing
The discharge of wastewater and sediment from shrimp farms is capable of having significant adverse effects upon the quality of receiving waters and the ecosystems. In addition, wastewater discharges are capable of spreading contamination and disease to other shrimp farms that are dependent upon the same receiving waters as a source of water supply. Where the quality of wastewater is a matter of concern, the problem may be most effectively addressed by the imposition of a licensing requirement upon the wastewater discharges from shrimp farms.

A suitably empowered authority should be entitled to impose conditions upon the quality of effluent that may be discharged from a shrimp farm, or to require alternative methods of effluent treatment.

The failure of a shrimp farmer to meet the conditions of a waste water discharge licence should be subject to a requirement that specific measures are taken to ensure that future effluent quality is satisfactory and perhaps, to a penalty.

Shrimp movement licensing
The unrestricted collection and movement of shrimp, potentially over large distances and between different countries and ecosystems, raises various concerns relating to the impact that the collection of stock and the introduction of non-native stock may have upon local aquatic ecosystems. Appropriate legal mechanisms are needed to address these concerns and these may take the form of prohibitions, restrictions or licensing measures to regulate the collection of stock from the wild and to control the introduction of non-native stock into shrimp farms.

The movement of living aquatic animals within and across national boundaries should be regulated consistent with the international standards and obligations (e.g. the Office of International Epizooties (OIE) International Aquatic Animal Health Code and the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement)).

The movement of diseased stock between shrimp culture installations in different ecosystems enables the transmission of disease with potentially devastating consequences for the industry. Hence this concern could be addressed by the imposition of an authorization requirement and the adoption of an information procedure concerning the movement of shrimp stock.

Disease and health management
Farmers, government and hatcheries should co-operate to develop a disease prevention and management plan to minimize disease incidence. Such a plan could include regular monitoring and control of major pathogens in farmed and wild stocks, reporting procedures and actions to be taken in the event of a potential or actual disease outbreak, as well as testing and certification of hatchery seed and location requirements.

States should adopt appropriate legislation to implement the disease and health prevention and management plan and report notifiable diseases to the Office of International Epizooties.

Genetically Modified Organisms
The possibility of practical use being made of genetically modified organisms in shrimp culture, outside secure laboratory conditions, is a matter which raises a range of environmental, ecological and commercial concerns which require a strongly precautionary legislative approach.

Whilst legislation governing the use of genetically modified organisms in shrimp culture is rapidly becoming a necessity, given the potential implications of genetic modification across all aspects of agriculture and fisheries, it may be preferable for this issue to be addressed under more broadly-based legislative instruments which regulate the use of genetically modified organisms generally.

Chemical use restrictions

The potentially harmful effects of various chemicals used in shrimp culture, in relation to both the environment, the farmers and the consumers of shrimp products, may be effectively regulated by the formulation of product standards and controls on the use and distribution of chemicals.

A list of chemicals the use of which is duly approved for the purposes of shrimp culture should be made available to the farmers.

Farmers should have the duty to record and report to the appropriate authority the use of chemicals in shrimp culture which are hazardous to human health and the environment.

A legal mechanism should exist to prohibit or restrict the use of chemicals that are seriously harmful to the environment or human health in shrimp culture. Where necessary, further similar controls should be applied to prohibit or restrict the import, manufacture, marketing, distribution and sale of relevant substances where these are done for shrimp farming purposes.

Where pesticides, veterinary medicines, food additives or other chemicals are lawfully used in shrimp culture, further measures should be established to monitor the presence of these chemicals in the broader aquatic environment and to ensure that they are not present in excessive concentrations in shrimp products.

Feed sources and utilization

Sources of feed used in shrimp culture should be selected to minimize adverse impacts upon the environment and the use of feeds should be conducted so as to secure minimum feed wastage and nutrient loss to, and contamination of, the environment.

It may be appropriate for legal powers to be provided to national authorities to certify commercial shrimp feed to confirm that undesirable constituents are absent or only present in allowable quantities.

Although the misuse of shrimp feed at the farm level may be effectively regulated by waste water discharge controls, the need for appropriate use of feed may be best considered within non-mandatory codes of practice addressed to shrimp farmers. Where possible, shrimp farmer organizations and government should collaborate in the development of such codes.

Product quality controls

Shrimp, as a food product, must be subject to a system of public health certification whereby processing, distribution and sale is regulated to ensure the safety of consumers.

Public health and food safety are clearly matters which extend beyond shrimp products, and it is sensible, therefore, that this area should apply consistent regulatory principles to all food products, and be enforced by a food inspectorate equipped with the specialized expertise to ensure that no contaminated product is allowed to enter any part of the food chain.

Initially, public health and food safety should be provided for, as a matter of national law, but insofar as shrimp products are intended for export they will also have to satisfy the public health and consumer safety requirements of those countries to which shrimp products are exported.

Internationalization of standards

In respect of food safety, it will be necessary for those countries that produce shrimp for export to meet agreed international standards.

Progressively, the FAO *Code of Conduct on Responsible Fisheries* should become influential in determining the scope and content of national legislation and countries should endeavor to amend national legislation to give effect to the Code.

ANNEX F: MEMBERSHIP OF WORKING GROUPS

Working Group 1:	**[On-farm management practices]**
Chair:	Colin Price
Co-chair:	Suraphol Pratuangtum
Rapporteurs:	Dan Fegan, Porfirio Alvarez Torres, Ken Corpron
Members:	Pornlerd Chanratchakool, George Chamberlain, Claude Boyd, Alfredo Santiago, Ross Lobegeiger, Peter Rothlisberg, Ilse Kiessling, Rezaul Karim, Stanislaus Sonnenholzner, Robin Macintosh, G Santhanakrishnan, Coco Kokarkin, Siri Tookwinas, Rolando Platon, Mehdi Shakoori, Rohana Subasinghe, Michael Phillips, Sih Yang Sim, Stefan Bergleiter
Working Group 2:	**[Off-farm (sectoral) management practices]**
Chair:	Jim Gillespie
Co-chair:	Le Thanh Luu
Rapporteurs:	John Hambrey, Jason Clay, Uwe Barg
Members	Hermawati Poespitasari (Emma), Tran Van Nhuong, Nigel Preston, Damian Ogburn, Greg Paust, Barney Smith, Dr Mazid, Anwara Begum, Duncan King, A. M. Jayasekera, Rafael Rafael, Ron Zweig, Melba Reantaso, Sunil Siriwardena, Richard Callinan, Rolf Willman
Working Group 3:	**Legal and Institutional Arrangements**
Chair:	Malcolm Sarmiento/Jim Tobey
Co-chair:	Sevaly Sen
Rapporteurs:	David Barnhizer, Annick Van Houtte, Nathanael Hishamunda
Members	Simon Wilkinson, Hambal Hanafi, Rob Swindlehurst, Martin Breen, David Edwards, Colin Shelley, Ian Yarroll, Mohd Saha Alam, Wu Chaolin, Agus Apun Budhiman, K. Gopakumar, Andreas Villadsen, U Than Tum, Pedro Bueno

ANNEX G: LIST OF DOCUMENTS MADE AVAILABLE TO THE CONSULTATION

List of documents submitted by the FAO Secretariat to the Consultation

- Prospectus and the Provisional Agenda
- Fegan, D. and J. Hambrey. Working paper on Operating Principles for Sustainable Shrimp culture.
- Hambrey, J. and D. Fegan. Working paper on Draft Guidelines for the Development and Implementation of Situation-specific GMPs at the National or Sub-national Level
- Van Houtte, Annick and Sevaly Sen. Working paper on Good Legal and Institutional Arrangements for Shrimp culture

List of documents submitted by delegates, observers and resource persons

- Anon. Shrimp Culture Renovation in Rushan, Shandong Province, China -- a case study report. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- Anon. Thematic Review on Management Strategies for Major Diseases in Shrimp culture. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment. Report of the Workshop held in Cebu, Philippines from 28-30 November 1999
- Anon. Thematic Review on Coastal Wetland Habitats and Shrimp culture. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment.
- Boyd, Claude E. and John A. Hargreaves. Codes of Practice for Marine Shrimp Farming. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- Boyd, Claude E. and Jason Clay. 2000. Evaluation of Belize Aquaculture, Ltd. a super-intensive Shrimp culture System in Belize. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- Boyd, Claude E. and Bartholomew W. Green. Coastal Water Quality Monitoring in Shrimp Farming Areas with an Example from Honduras. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- Dewalt, Billie R., Lorena Noriega, Jaime Renán Ramírez Zavala Rosa Esthela González. Shrimp culture, people and the environment in coastal Mexico. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- FAO. Report of the Bangkok FAO Consultation on Policies for Sustainable Shrimp Culture. Bangkok, Thailand. 8-11 December 1997. FAO Fisheries Report. No 572. Rome, FAO.
- Pednekar, Sunil S., Nguyen Huu Thien, Pham Le Thong, Truong Hoang Dan. Mixed Shrimp Farming-Mangrove Models in the Mekong Delta: A Socio-economic Study. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- Schwab, Barbara; Michael Weber; Bernard Lehmann. Key Management Challenges for the Development and Growth of a Shrimp Farm in Northeast Brazil: A Case Study of "Camanor Produtos Marinhos Ltda.". Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- Siriwardena P.P.G.S.N. 2000. Draft report on the code of best practices for shrimp culture in Sri Lanka. Working paper of the WB/NACA/WWF/FAO Consortium Programme on Shrimp Farming and the Environment
- Tobey, J., J. Clay, and P. Vergne. 1998. "A Difficult Balance: The Economic, Environmental, and Social Impacts of Shrimp Farming in Latin America," Coastal Management Report #2002, The Coastal Resources Center, University of Rhode Island, Narraagansett
- Tookwinas Siri, Randy Show, Waraporn Prompoj, Surasak Dirakkiat Wichai Lapjatupon. 1999 The Marine Shrimp Culture Industry of Thailand Code of Conduct

- Tookwinas Siri, Surasak Dirakkait, Waraporn Prompoj, Claude E. Boyd. 1999. Marine Shrimp Culture Industry of Thailand; Operating Guidelines for Shrimp Farms

ANNEX H. PROSPECTUS OF THE CONSULTATION

FAO/GOVERNMENT OF AUSTRALIA EXPERT CONSULTATION ON GOOD MANAGEMENT PRACTICES AND GOOD INSTITUTIONAL AND LEGAL ARRANGEMENTS FOR SUSTAINABLE SHRIMP CULTURE
in Co-operation with
the World Bank (WB), the Network of Aquaculture Centres in Asia-Pacific (NACA), and the World Wide Fund for Nature (WWF)

Brisbane, Australia, 4-7 December 2000

Prospectus

Background

In December 1997, FAO convened the Technical Consultation on Policies for Sustainable Shrimp Culture which brought together government delegates and observers from 12 countries of Asia and America accounting for about 90 % of the global production of cultured shrimp and including major consuming countries. Observers from 5 inter-governmental organizations and from 4 international NGOs also attended. The Consultation noted that the achievement of sustainable shrimp culture is dependent on effective government policy and regulatory actions, as well as the co-operation of private sector in utilizing sound technology in its planning, development and operations. In this regard, the Consultation recommended that FAO convene expert meetings to elaborate best practices for shrimp culture and desirable elements of the legal and other regulatory instruments for coastal aquaculture.

The Network for Aquaculture Centres for Asia and the Pacific (NACA), in partnership with the World Bank (WB), World Wild Fund for Nature (WWF) and FAO are implementing a Co-operative Programme on Shrimp Culture and the Environment (CPSCE). A central objective of the CPSCE is to identify good management practices (GMPs) under various environmental, economic and social conditions and assess the cost-benefits for farmers to adopt these GMPs individually and in co-ordination with other farmers. This information is expected to help governments and the private sector to develop support strategies and specific assistance measures for farmers to overcome the constraints that currently prevent them to adopt GMPs. These strategies may encompass the adoption of industry codes of good practices, improved extension services, economic incentives, and others. CPSCE is undertaken primarily through a series of case studies covering all major producing regions of cultured shrimp. Moreover, CPSCE is preparing guidelines for the economic and financial analysis of GMPs.

Industry guidelines and codes of good practices have been developed, or are under development, in a number of countries (e.g. Australia, Belize, Ecuador, India, Malaysia, Sri Lanka and Thailand). At international levels, a code has also been elaborated by an industry organization, the Global Aquaculture Alliance (GAA) which is intended to provide the basis for a future eco-labelling programme. Guidelines are also under development for the production of organically grown shrimp.

One area of special concern is GMPs on shrimp culture health management. FAO has been active in providing assistance to several member countries on health management in shrimp culture and has taken the lead in conducting the review on management strategies for major diseases in shrimp culture, one of the thematic reviews under the CPSCE. A number of programmes in co-operation with several agencies and organizations, with the view to develop GMPs on shrimp health management are being currently conducted by FAO in both Asia and Americas.

The Legal Office of FAO is currently working on a comparative survey of national laws and regulations governing shrimp culture. The purpose of the study is to examine and compare relevant national legislation, particularly legal requirements concerning the environmental impacts of shrimp culture activities and measures applicable in relation to the development of shrimp farming installations, continuing operational controls, and legal requirements which apply on the cessation of activities and aspects related to enforcement of relevant legislation. This information is expected to help in the identification of good institutional and legal arrangements (GLIAs) and in an assessment of current constraints for countries to adopt them.

Objectives and Outputs of the Expert Consultation

The Expert Consultation is being convened in order to:

1. provide a recognized international forum for discussion on major aspects related to the promotion of sustainable shrimp culture practices as well as of related institutional and legal instruments

2. to continue facilitating the process of consensus-building among major stakeholders concerned with shrimp culture development and management

3. to identify/determine avenues, as well as specific benefits and limitations, for the development and implementation of Good Management Practices and Good Legal and Institutional Arrangements leading to improvements in shrimp culture management practices at farm and institutional levels.

The Expert Consultation is expected to produce the following outputs:

1. A set of 'generic' farm-level GMPs that are widely applicable in shrimp culture throughout the world.
2. Guidelines for the development and implementation of situation-specific GMPs at the national or sub-national level; these guidelines would relate to, *inter alia*, the identification of situation-specific issues, the methodology for cost-benefit analysis of GMPs; stakeholder participation; and others.
3. Constraint analysis for the adoption of GMPs and how to overcome them, including strategies to support farmers and farmer organizations in implementing better management practices.
4. A set of 'generic' GLIAs that are widely applicable in shrimp culture throughout the world.
5. Guidelines for the development and implementation of country-specific GLIAs that take into account a country's specific legal and institutional conditions.
6. Constraints analysis for the adoption of GLIAs and how to overcome them, including strategies to support implementation of such better institutional and legal arrangements.

A set of discussion guides, working papers and other specific meeting documents will be prepared to facilitate structured and targeted discussion, in working groups and plenary, leading to generation of above outputs.

Participants

The participants will include a limited number of selected experts from governments; environment, development and industry NGOs; international and regional organizations and academia. Experts from international agencies and international NGOs and from developed countries' governments are expected to cover their own cost of attendance.

Venue and date

The Expert Consultation will be held in Brisbane, Australia in the period between 4-7 December 2000. The date and venue have been chosen to coincide back to back with the 12th Session of the NACA Governing Council, 28 November – 1 December 2000.

Technical Secretariat

The Co-Technical Secretaries are Mrs. Annick Van Houtte, FAO Legal Office, Mr. Uwe Barg, FAO Fishery Resources Division, and Mr. Michael Phillips, NACA. The contact person for arrangements in Australia is Mr. Jim Gillespie. Following are their contact details:

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ANNEX J - THE SUMMARIES OF PRESENTATIONS AND MAIN DISCUSSION POINTS OF SESSION I

The WB/NACA/WWF/FAO Consortium Programme on Shrimp Framing and the Environment and other Experiences: Lessons Learned – Michael J. Phillips, Jason W. Clay, Ronald Zweig, and Rohana P. Subasinghe. The presentation described the World Bank, NACA, WWF and FAO Consortium Programme on Shrimp Farming and the Environment. The Consortium Programme is intended to analyze and share experiences on the better management of shrimp culture in coastal areas.

The geographical scope of the Programme is world-wide, including major shrimp producing countries in Asia, the Americas and Africa. Phase 1 started in July 1999 and finishes in December 2000. The synthesis of studies, and management practices, will be undertaken in 2001. The funding for the programme is provided by the World Bank-Netherlands partnership programme, WWF, FAO and NACA.

Shrimp farming is a very diverse sub-sector, economically, in terms of farming systems and geographic location, environmentally and socially. Much shrimp farming in Asia's undertaken by small-scale farmers owning less than 5 ha of land, and in both Asia and Latin America, shrimp farming is an important source of employment and income for hundreds of thousands of people. Employment and income is generated in supply industries as well as in shrimp processing and distribution, including retailing. Controversy over social and environmental problems associated with shrimp culture in shrimp producing and importing countries has arisen. Generally, issues raised include: social and ecological consequences of coastal habitat changes, nutrient and organic release and water quality issues, biodiversity issues, such as collection of wild seed, social issues, equity and conflicts. Sustainability of shrimp farming has been questioned because of shrimp disease outbreaks, and significant economic losses. Such problems emphasize the importance of identification and promotion of effective on-farm and sectoral management practices.

A number of past and ongoing initiatives have been taken in various meetings organized by the private sector, governments and international/regional organizations, including the Bangkok FAO Technical Consultation on Policies for Sustainable Shrimp Culture (8th- 11th December 1997), that produced a consensus "that sustainable shrimp culture is practised and is a desirable and achievable goal which should be pursued". The Consultation emphasized the need to identify appropriate management practices leading to sustainable shrimp culture, and vigorous promotion of such practices. The Network of Aquaculture Centres in Asia-Pacific (NACA) is addressing sustainability issues in shrimp culture, in support of the implementation of relevant Articles on Aquaculture Development in the Code of Conduct for Responsible Fisheries (CCRF). Private sector associations and national and international non-government organizations (NGOs) are also focussing on sustainable shrimp farming practices. The World Bank in 1996-98 completed a study of the environmental interactions of shrimp culture. It examined the suitability of shrimp culture for poverty alleviation in coastal areas. It recommended further specific case studies to generate key information on management strategies for sustainable development of shrimp farming.

Recognizing the importance of co-operation and co-ordination among efforts to promote better management practices in shrimp culture, the consortium was formed comprising four agencies; the World Bank, NACA, WWF and FAO. The Overall programme objectives of the consortium are: (1) To generate improved information on key issues for sustainable shrimp culture development and management; (2) To facilitate consensus building among stakeholders at various levels from international, regional, and national, through to local levels; (3) To identify management strategies for sustainable shrimp culture (which will be of assistance to the financing and executing agencies, participating countries, investors, and farmers), (4) To provide a basis for broadly informing policy makers on management strategies for sustainable shrimp culture; and (5) To provide a platform for identification of future development activities and assistance for implementation of management strategies for sustainable development of shrimp culture.

The programme involves thematic reviews, and country specific cases studies, including Asia, Africa and Latin America. Thematic reviews cover identification of better management practices, with a complementary review on implementation through Codes of Conduct and Practices; management strategies for shrimp viral diseases, social aspects and poverty alleviation, and mangroves and coastal habitat rehabilitation. The case studies in Asia cover Shandong province, China, Bangladesh, Indonesia, India, the Philippines, Thailand, Sri Lanka, and Vietnam. In Africa, a summary of existing experiences with shrimp culture is being prepared. Case studies in Central and South America involve Honduras, Belize, Colombia, Mexico, Ecuador, Brazil and Peru.

The background and case study reports are being made available on a web site (www.enaca.org/shrimp) and a synthesis of findings is being prepared during 2001. The follow will focus on implementation and further co-operation/partnership, and dealing with questions that remain. This Expert Consultation represents an important opportunity for review of the studies undertaken and an important step towards identification, development and implementation of better management practices.

Thematic Review on Coastal Wetland Habitats and Shrimp culture - Donald Macintosh, Michael J. Phillips[1], Barry Clough, and Robin Lewis. A thematic review on coastal wetland habitats and shrimp culture is being carried out as part of the World Bank/NACA/WWF/FAO Consortium Programme. The geographical scope of the review is Asia and South America. The review covers the major interactions between shrimp culture and coastal wetland habitats, with special reference to mangroves, mangrove rehabilitation, and experiences in co-existence between aquaculture and mangroves. Also covered are social, economic and institutional/legal factors governing co-existence and rehabilitation.

A workshop was held with the private sector, government scientists, policy makers and NGO participants to discuss the preparation of the review. The agreed objectives are as follows: "To promote coastal aquaculture in an environmentally responsible basis, adopting the principles of co-existence, of supporting livelihoods of local communities, and a net increase in mangrove area, where the policy of the country concerned"

The major components of the review include a synthesis document, country case studies in Bangladesh, Ecuador, India, Sri Lanka, Philippines and Thailand and cases demonstrating various 'management' practices. These cases cover zoning and legislation, the use of mangroves in effluent treatment (in Colombia, Australia and Indonesia), mixed shrimp farming-mangrove systems (in Vietnam and Indonesia) and poverty alleviation and social and economic issues. The review also gathers experience and analyses on mangrove rehabilitation in disused shrimp culture ponds.

Management interventions include: (1) Before shrimp farm development, including policy, legislation, coastal management planning and zoning, siting of farms behind mangroves and maintaining buffer zones and mangrove functions; (2) During the construction and operational phase, when factors such as design features and construction practices, on-farm management practices and systems, effluent treatment and biofilters and mixed farming systems can be considered; and (3) After rehabilitation and restoration of disused ponds. The review gives examples of the management practice options and critical success factors concerning the management at each level.

The Shrimp Culture Industry Better Practices for Addressing Poverty and Social Equity Issues – J. W. Clay. The shrimp culture industry has made significant contributions to global shrimp production as well as the foreign exchange earnings of producing countries. However, there are also concerns that the industry has fallen short on its potential to deliver positive social impacts. For this reason the Consortium Programme on Shrimp Farming and the Environment decided that one thematic review would identify and analyze innovative approaches to improve the social and equity impacts of the industry.

The thematic review has focused on four issues in both Asia and Latin America. The first task was to identify areas where the shrimp industry can improve its social performance. The primary focus was to look both at those employed within the industry as well as those affected by it. A second focus was to explain or analyze (including financial analyses) better social practices so that producers can understand and adopt them when appropriate. The research identifies a range of better practices that could have an immediate impact on the industry. Particular attention is given to better practices that improve overall performance, or reduce costs, of operations. Finally, the better practices will be promoted to encourage adoption and create the next generation of better practices.

No shrimp farmer started business to hire people or stimulate local "development." Many, however, have found that it makes financial sense to improve their social impacts. By the same token, few farmers are teachers although most want to learn. While farmers may be social innovators, few are prepared to document what they do much less teach about their innovations. For example, many farmers have found that retaining higher paid existing employees is more efficient than hiring cheaper workers who know nothing. Turnover has huge opportunity costs. Likewise, performance

[1] Presented a brief summary of this thematic review, authored by Macintosh *et al.*

incentives, based on their contribution to net profits rather than simply increased production, can have positive social impacts. The goal is to promote efficient use of resources and the reduction of waste.

There are several key areas where innovation has occurred. There are, for example, direct employment issues that relate to salaries, benefits and the use of permanent vs. part-time or contract labor. Increasingly, incentives and bonuses are adopted because they have a positive impact on net profits. In some cases, all other things being equal, net profits were more than doubled. But, the analysis also shows that there are real costs of bad practices. The shrimp industry spends considerable money on fencing, guards, lawyers, PR and lost permits because of social conflicts with neighbors or other resource users.

The review highlights a wide range of social benefits or "outside-the-box" innovations. Many producers invest in human resources (e.g. education or specific training, health) and infrastructure because it is an investment that pays off in many ways. Several innovations offer "win-win" solutions where benefits accrue to the producer as well as to workers or neighboring communities. These activities can include such approaches as developing spin-off businesses for transport, food or laundry that are owned by workers or neighboring communities; allowing community or workers to cut wood in mangroves to stimulate growth and improve their performance as biofilters; creating joint ventures for ponds, hatcheries and/or processing plants with worker or community groups; developing profit sharing programmes with workers or community landowner groups; transferring ownership from corporations to communities after 5-15 years; and rent or lease on-farm management to neighboring small-farmer, collectively-owned shrimp farm and creation of jointly owned processing plants.

The information in the thematic review will be organized around key issues and posted on a web site. The information will be up-dated periodically with new information or examples as they become available. Any information or examples are welcome particularly specific examples of innovations as well as information on the impact of the industry's contribution to government through taxes. This information is not well documented.

Codes of practice for shrimp farming – C. Boyd. A review of Codes of Conduct for shrimp farming revealed that these documents consisted primarily of brief statements of practices that could be applied to minimize negative environmental impacts. These statements represent logistical objectives, but the amount of detail provided for the practices is not sufficient, in most cases, to explain how the practices should be applied. Thus, operation manuals are needed that explain methods for applying practice. Another common shortcoming in the Codes of Practice is the limited coverage of social issues.

There has been little implementation of the practices in Codes of Conduct. At present, the practices are nicely written in document form, but they have not been installed on farms. Of course, Codes of Conduct have been widely publicized, and it is expected that this publicity may be providing some benefits. Shrimp farmers are hearing and thinking more about environmental performance. Nevertheless, if Code of Conduct programmes are to produce their maximum benefits, aggressive implementation programmes must be initiated.

The most advanced Code of Conduct programme is the Responsible Aquaculture Programme of the Global Aquaculture Alliance. This organization has developed best management practices and quantitative standards for their programme.

A method for developing a compliance plan for the Responsible Aquaculture Programme has been developed. Once participants have implemented the compliance plan, third party inspection will be used to verify compliance with the programme.

There are several advantages to Codes of Conduct programmes, as follows: the potential to reduce negative impacts; increase efficiency of production; allow input to stakeholders; provide an avenue for introducing good practices; allow co-operation with government regulatory agencies; and marketing advantage. The main disadvantages of Codes of Conduct is that they are voluntary, there has been little implementation, and benefits are assumed rather than proven.

Survey of Legal and Institutional Arrangements – A. Van Houtte. A survey has been conducted and is being finalized to provide a comparative account of legal provisions concerned with shrimp farming which are operative in different countries engaged in the activity; and to offer suggestions as to the possible contents of good legal and institutional arrangements for the regulation of shrimp farming.

The survey places particular emphasis on the legal requirements which relate to the environmental impacts of shrimp farming. Such impacts are broadly of two kinds: (1) "access" = the initial impacts of establishing a shrimp farm at a particular location, and the potential adverse effects that this may have upon biodiversity and the potential conflicts that may be raised with other competing uses of land and water; and (2) "actual operation of a shrimp farm" = the continuing environmental impacts, upon environmental and ecological quality, which may arise through the actual operation of a shrimp farm when once it is established at a particular location or, indeed after cessation of activities. A third group of associated concerns relates to the efficiency of the shrimp farming industry and the quality of the products which it produces, and which often reflect underlying environmental concerns.

The survey provides information on the following topics: National approaches towards "sustainable development"; Legislation; Institutional responsibilities; Devolution of controls; Acquisition of land rights; Location licensing for the establishment of shrimp farms; Continuing controls upon shrimp farming activities; Freshwater use regulation; Waste water discharge regulation; Shrimp movement regulation; Genetically modified organisms; Chemical use restrictions; Food sources and utilization; Product quality controls; The internationalization of standards; Guidance and producer's organizations; Enforcement; and other issues.

In the countries on which information was sought on shrimp farming legislation, responses proved to be of highly variable quality. Supplementing incomplete responses were even more acute where no response was provided.

What does the survey suggest? There is legislation but it often fails to recognize the distinctive nature of shrimp culture. The activity is also subject to a bewildering range of regulatory regimes with distinct, and sometimes, conflicting objectives. Consolidation of provisions governing shrimp culture in a single enactment might be seen as a beneficial move in some jurisdictions. There are issues not unique to shrimp culture e.g. GMOs, water use, and food safety issues but still this should not be a reason why shrimp farming can be regulated as a range of distinct and fragmented activities.

A distinctive feature of shrimp farming is the need for a relatively high level of technical expertise to be possessed by those who must regulate certain aspects of the activity. It is imperative to provide institutional support somehow and that the geographical and technical demands involved are taken into account when allocation of institution responsibilities is determined.

The conditions of access to land and to capital are key factors (often more important than profitability) towards a responsible development and management of shrimp culture.

There appears to be relatively little use of licensing systems to impose general continuing controls upon shrimp farms, indicating a lack of monitoring and control. A general operation licence governing day to day activities instead of a proliferation of licensing requirements which may apply to a particular shrimp farm. Codes of conduct are coming to the forefront. Definitely this is a timely call for good legal and institutional arrangements that can change the image of shrimp culture be it for the international and national.

Shrimp health management strategies – R.P. Subasinghe. Disease has become a major constraint to shrimp culture, especially since the outbreak of White Spot Syndrome Virus (WSSV). Some estimates on economic losses are available. The presentation was based on the recommendation and conclusions of the WB/NACA/FAO/WWF Joint Expert Consultation on Management Strategies for important Viral Diseases of Shrimp, held in Cebu, Philippines in November 1999 which reviewed, in detail, the status of shrimp health in Asia and Americas; discussed the strategies used for managing shrimp health during major outbreaks in different countries by different stakeholders; evaluated the successes and failures of such strategies; examined the investments made and costs and benefits of improved management practices; and looked at how effective the responses were. Where the responses were not effective, the possible reasons for these were discussed. The consultation tried to understand what lessons could be learned for future interventions; what forms of co-operative arrangements could work best; what specific needs could be identified as important to be addressed under co-operative arrangements; how effective has regional and inter-regional co-operation been; and what type of regional and/or inter-regional co-operation could be effective.

From the workshop recommendations, it was clear that there have been many interventions by all parties to address the current shrimp disease situation at farm level, co-operative or local level, national level, and international levels. The interventions came with varying success; some have

been effective and some have not. The Report of the Consultation contains many detailed recommendations as well as some broad management strategies, particularly with reference to movement of live shrimp.

When considering the epidemiology and spread patterns of diseases and pathogens of shrimp, especially the viral pathogens, there is convincing evidence that disease outbreaks are associated with movement of live shrimp [broodstock and post-larvae (PLs)]. The potential implications on aquatic biodiversity and human health have also being recognized. Therefore, it is important to remain very cautious over the international or regional movement (also national in large countries) of live shrimp stocks bound for aquaculture. This precaution would apply even to domesticated stocks and to a single shrimp species cultivated in different places. However, movements should be permitted when proper quarantine and screening procedures have been applied, according to the agreed upon international treaties and standards. In the Asia-Pacific region, an Asia Regional Technical Guidelines on Health Management for the Movement of Live Aquatic Animals has recently been adopted by 21 countries of the region. The Technical Guidelines provide countries with technical guiding principles towards minimizing risks of trans-boundary movement of pathogens through responsible and safe movement of live aquatic animals.

There is concern about the risks involved with the movement of shrimp products as contributing to the trans-boundary movement of pathogens. Responsibilities of farmers, processors, and traders, have been questioned. Management practices, institutional support, human capacity, and legal frameworks for facilitating responsible movement/trade of shrimp products appear to be inadequate.

Shrimp health management should be a long-term strategy. The current understanding of technical avenues and options for controlling shrimp diseases, especially WSSV, has improved over the past years, mainly through the experience gained in Asia and in Latin America. The ultimate solution for combatting shrimp disease problems is to culture certified domesticated stocks free of specific pathogens on nutritious dry feeds in bio-secure ponds under conditions non-stressful to the shrimp. This should be the long-term goal for the shrimp industry. With regards to farm health management strategies, there are both manageable and unmanageable risk factors involved in the culture process. With respect to stress, it's impossible to control weather, but it is possible to control pond carrying capacity, feed inputs and water exchange. At present, the dry feeds appear to be adequate, although there is obviously still room for quality improvement. The biggest potentially controllable problems that farmers currently face are uncertainty regarding the quality of PLs used in culture and the bio-security of the pond environment from pathogen carriers. The simplest way to solve PL quality problem is to change from the use of PLs derived from captured broodstocks to PLs derived from domesticated stocks. However, this practice requires considerable research efforts and field-testing, and is still beyond our grasp. The shift from wild PLs to domesticated, hatchery reared PLs requires adequate consultation and careful planning, as this process may result in significant social and economic implications. Finding alternate good practices may be considered at the beginning and appropriate institutional, policy, and regulatory environment is essential for a successful transition.

Farm health management strategies must include ensuring bio-security in ponds through appropriate screening of PLs for important pathogens prior to stocking. The procedures and methodologies for screening PLs for important pathogens (currently the WSSV and for some others) are known. However, some training, capacity building, and upgrading and infrastructure development of hatcheries and diagnostic centres are necessary. There are some vital requirements – technical standards developed and harmonized, standardized, validated and agreed upon by the hatchery producers, both nationally and internationally.

Pond management strategies may include creating a rearing environment secure from disease carrying reservoir species. There are many existing alternatives. Completely closed, re-circulating culture systems comprise one alternative. Filtration is also possible in many instances. The required changes may not be financially feasible or physically possible depends on the type of operation. With respect to chemical usage, where treatments are required, responsible and safe use of drugs and chemicals are essential.

Development and provision of good management practices, appropriate standards, and adequate institutional and legal frameworks are imperative. Awareness building and education among farmers is essential for the effectiveness of all interventions. Co-operate strategies are vital in the process. Experience in establishing aquatic animal health information systems in Asia, and the benefits that the sector achieved through such programmes were considered important. Establishment of an appropriate, self-sustaining aquatic animal health information and reporting

networks would be highly valuable in ensuring that the vital technical and scientific information are made available to the shrimp farming sector. This will also help to reduce trans-boundary movement of aquatic pathogens.

Developing technical guidelines and standards on health certification for safe trans-boundary movement of live aquatic animals (broodstock and PLs of shrimp), and harmonizing them within a region, and among regions, was considered timely and appropriate and is now in place in Asia. However, this will take some time to realize and compliance will remain an issue until appropriate national capacities, policies, and enforceable regulatory frameworks are developed. Capacity building among national institutions involved staff, and shrimp farmers are important. Farmers should be made aware of the options and opportunities available for controlling diseases, especially the WSSV.

Development of good farm and hatchery management practices and documenting them with adequate scientific evidence and field data is also considered as vital to the sustainability of the sector. There are many ongoing activities by many agencies and organizations in support of shrimp health management in Asia and Latin America. They deal with many issues and any new assistance programmes from other sources should be complementary and should benefit from them.

It was concluded that diseases will continue to emerge. Efforts to control them will be pursued and there will always be a range of problems to be tackled along the way. The varying levels of political, economic and social development among countries, the trans-boundary nature and commonality of many major disease problems, and the need to harmonize approaches, all strongly argue for effective co-operation at all levels of management in order to make the most effective use of limited resources. Wide-ranging stakeholder consultation and consensus building (at all levels) is crucial. Building on sub-regional, regional and international co-operation through joint strategies and harmonized approaches that avoid duplication of effort and competition are essential for this process. However, all such efforts will be ineffective without national commitment from responsible authorities. The current situation offers a big challenge to all concerned and, if maintained at the present level, risks of major epidemics will continue to threaten and emerge with costs that extend far beyond economics.

Environmental Management of Shrimp Farming in Australia – Nigel Preston, M. Burford, Peter Rothlisberg and C. Jackson. In Australia, strict Commonwealth and state environmental regulations have constrained uncontrolled development of shrimp farming. A high level of resources, relative to the size and value of the industry, has been devoted to collaborative research on the environmental management of shrimp farming in Australia. This research has quantified nutrient processes in shrimp ponds, determined whole farm nutrient budgets, analyzed effluent composition, determined the effects of different effluent treatment strategies and traced the fate of effluent in receiving waters. The results are being used to provide a scientific basis for discharge license requirements for shrimp farming. These data are also being incorporated into an advanced geographic information and decision support system in order to improve site selection and aquaculture planning.

Despite these improvements, there are ongoing public concerns about the environmental management of shrimp farms. One potential avenue for providing a more logical and systematic basis for this debate is through the establishment of environmentally sustainable development (ESD) performance criteria for the industry. This process has already commenced with an initial focus on the Queensland shrimp farming industry. This study has identified that the environmental management of shrimp farms needs to be incorporated into environmental management of the water body and catchment adjacent to shrimp farms. By this means, aquaculture can be compared to other forms of agriculture, particularly in relation to permitted discharge loads. This concept is not unique to Queensland or Australia but has rarely been addressed. We anticipate that this study will provide an opportunity to determine more effective ways of broadening the environmental planning and licensing of shrimp farming to include environmental standards for the whole catchment.

Social aspects of coastal shrimp culture in Bangladesh - Anwara Begum. Caritas, a NGO in Bangladesh, conducted a case study on "Social Aspects of Coastal Shrimp culture in Bangladesh". The study applied Participatory Rural Appraisal (PRA), Group Discussion (GD), key informant interviews, workshops with Government, NGO and other stakeholders to assess social impacts and management of shrimp culture in selected coastal areas in the south-western part of Bangladesh. Polder 23 (Sholadana Union) under Paikegacha Upazilla and Polder 33 (Dacope Union) under Dacope Upazilla have been selected for study. In addition the study team had a preliminary

assessment over the situation in Polder 22 under Paikegacha Upazilla. Four PRAs with shrimp farmers and women from poor landless families (mainly fry collectors) at village level and four Group Discussions with the secondary stakeholders at Upazilla, District/Division and National level were conducted.

Over the last decade or so significant developments have been taking place and three polders now look quite distinct from each other. Polder 23 has been experiencing all the facilities of shrimp culture as since 1991 it has been witnessing planned shrimp culture under the Third Fisheries Project. Polder 33 has been experiencing shrimp culture in an unplanned manner. Polder 22, having all the elements of potential shrimp farming, deliberately opted out of it. The Delta Development Project had some role to play in excluding this polder from shrimp production. So all these polders stand on different scales in terms of natural environment, and the status of shrimp farming. It is therefore, useful to compare the social environment in these three polders with different degrees of shrimp culture experiences, and to document the effectiveness of different management practices.

The livelihoods of the people of the study area are mostly dependent on agriculture (crop and shrimp culture mainly), fishing, crab and shrimp fry collection from the adjacent rivers. Shrimp culture has been the singular dominant economic activity over the last two decades in the areas. Twenty-two types of activities related to shrimp and agriculture are identified in both the polders. Even in the non-shrimp polder 22, shrimp culture indirectly provides significant livelihood benefits to people living in the polder. Landless people are involved in fry collection, or grazing cattle from nearby shrimp polders.

Traditional *gher* fisheries are an age-old practice in some areas of coastal belt in Bangladesh. In the traditional types of *ghers*, juveniles of fish and shrimp were allowed to entire the *gher* with tide water during spring tides through sluices. This practice of natural stocking of the *ghers* has been progressively replaced by artificial stocking of the *ghers* after construction of coastal embankments. Coastal embankments provided improved protection from natural hazards such as tidal surges and provide an opportunity for shrimp culture inside the polders. Rich outsiders primarily initiated shrimp culture, two decades back, creating social conflicts. However, small local farmers are becoming conscious about the economic benefits from shrimp culture, and are finally come forward to cultivate shrimp into their own land collectively and thus the presence of outsiders in shrimp farming has been declining. This change in land use and ownership patterns has significantly reduced conflict in some parts of Bangladesh.

Shrimp culture has rejuvenated the stagnant rural economy in some coastal areas but has also resulted in new environmental management problems, involving land and water, leading to social tensions. Intervention by the World Bank supported Third Fisheries Project in polder 23 indicates that planned shrimp culture with technical support to local people can reduce environmental costs. The social consciousness of the ordinary people living in Polder 23 developed under project has improved. The project benefits include increased savings, improve infrastructures, better social and natural environment, reduced influence of outsiders and greater co-operation among small landowners. The activities of a NGO (Caritas) was successful in promoting local shrimp farmers to participate in shrimp cultivation rather than leasing out the land to outsiders. Farmers are now able to cultivate paddy and shrimp in rotation, thus contributing to a reduction in social tensions. The major benefits resulting from shrimp culture in Polder 23 are: (a) improvement in livelihoods in terms of better income and improved living condition, (b) average daily wage rate has increased, (c) number of earning members per household increased; (d) price of land raised; (e) mobility of women in outside home activity increased; (f) helps to stimulate small business in the vicinity of shrimp farms; (g) Food security in household level enhanced; and (h) collection of shrimp fries from nature has emerged as secondary source of income.

Social conflicts result from improper distribution of benefit from shrimp farming. Among them the most important factors are a) Sluice gate and water management, b) Fault in deed writing, c) Leasing system , d) Lack of mechanism on dispute resolution, e) Control of *khas* land, f) Land is not backed timely, and h) *Hari* is not paid regularly. Besides these, there are minor conflicts too. A possible solution for managing the conflicts has been generated. The important issues are: (a) Clearly mentioning all related conditions while writing a deed agreement and these should be kept with both the parties; (b) Leasing should be made for a period of at least five years and 85% land owners need to be agreed in leasing the *gher;* (c) Existing leased out canals should be cancelled to make the water accessible to the shrimp farmers; (d) All occupied sluice gate must be kept free; (e) countable Block committees should be formed again and power should be given to these committees; (f) encouragement and financial support should be provided to the small *gher* owners; (g) Legal protection must be given to the small *gher* owners; (h) Basic utility services need to be

provided in the shrimp culture area; (i) a fund may be generated to support the affected families; and (j) a policy must be to consider keeping five *bighas* of land for grazing in every 100 *bighas* of shrimp culture areas; and (k) finally forming a polder based committee is recommended to manage the local conflicts.

Implementation of the Code of Conduct for Shrimp Farming: Preliminary Results from Demonstration in Thailand – Siri Tookwinas, Putth Songsangjinda, Krissana Chankaew, M.J. Phillips and Sih Yang Sim. The mission statement on the environment policy basis for the Code of Conduct for Sustainable Marine Shrimp Farming in Thailand was signed in 1998 by government and shrimp farm industry representatives (Department of Fisheries, Marine Shrimp Farming Association, Frozen Food Association, Canning Food Association, Aquaculture Business Club, Buyer and Seller Club, Animal Feed Mill Association) under initial support from the World Bank. Guidelines on the farming methods based on the Code of Conduct were prepared in a consultation workshop among the farming associations in various coastal locations, and with technical inputs from universities and the Department of Fisheries. Based on the guidelines, more locally specific manuals have been prepared in small local workshops with groups of volunteer shrimp farmers. These manuals have been prepared in Songkhla and Rayong provinces in early 2000. After preparation of the manuals, a trial has been started at these two locations to demonstrate intensive marine shrimp farming using the principles of the Code of Conduct. The trials were started in early 2000 at two farming sites in Songkhla and Rayong.

The pond preparation, shrimp fry stocking, culture technique, water management, feeding, chemical and drug usage, shrimp health management, effluent management, harvesting, social responsibility, training and documentation have been carried out following the Code of Conduct. A monitoring programme for water quality in the culture pond, farming area, farm sanitation, effluent treatment, social conflict observation and documentation checking was carried out by staff of Department of Fisheries. Shrimp harvesting was done in October 2000. The yield is still high in comparison with previous crops (normal operation without using the Code of Conduct manual), although operational costs are less. The paper presents the results of the demonstration trials which indicate that implementation of the Code of Conduct can lead to more profitable farming.

These favorable results provide a basis for further dissemination of management practices following the Code of Conduct for shrimp farming, which it is hoped will be widely accepted among the shrimp farmers in Thailand.

Case studies of shrimp culture in North and North Central Vietnam - Tran Van Nhuong. This case study on coastal aquaculture management was carried out in the North and North Central coastal area of Vietnam. The study was based on primary and secondary data collected through participatory discussions and structured interviews with aqua-farmers, agriculture farmers, extension officers, commune key persons, and local, provincial and national level officials.

The objectives of the study were to describe the current coastal aquaculture practices, the impact on the livelihood of the coastal inhabitants (aqua-farmers and non-aqua-farmers) and on the environment, to discuss the current situation in relation to the respective articles in the Code of Conduct for Responsible Fisheries (CCRF), and identify issues where better management practices should be introduced.

Coastal aquaculture activity in Bang La, Quang Thuan and Quynh Bang provinces (the North and North Central of Vietnam) showed an increase after 1990 under the influence of the Doi Moi economic reform in Vietnam but is currently still characterized by extensive and improved extensive culture systems of small-scale farmers with low input use and leading to low productivity levels, but the transition to semi-extensive culture systems is beginning. The cultured species are mainly tiger shrimp and mud crab. Aqua-farmers are showing a tendency to specialize in tiger shrimp monoculture, which offers higher net benefits but is very prone to diseases and therefore implies higher risks. The current production systems include two annual crops (shrimp/shrimp, crab/crab or shrimp/crab), average stocking densities of 2.3/m^2 for shrimp and 0.9/m^2 for crab in ponds of 0.8 ha and a depth of 0.8 m. Inputs provided are mainly limited to lime, livestock manure, fertilizer, pelleted feed, trash fish and molluscs, of which only lime is supplied in appropriate quantities in one commune.

Negative environmental impact of coastal aquaculture development in the 3 communes is low because the expansion of aquaculture did not result in the destruction of large areas of mangroves (instead marshland, swamps and salt fields were converted into ponds) and the present mode of production (improved extensive) has limited effluent impact. The only sign of negative

environmental impacts are observed in crab of which the prices of crab seeds are rising indicating a local overexploitation of the species.

Coastal aquaculture activities in the three communes investigated is currently changing rapidly from (improved) extensive to semi-intensive. Rapidly increasing population in the coastal areas is a major incentive in this process. To generate more employment and income coastal aquaculture needs to change to smaller ponds per household and higher uses of inputs leading to a higher productivity per hectare, and hopefully higher net benefits per hectare. Productivity of small ponds (around 0.2 ha) appeared to be tenfold higher than of large ponds (>1 ha). However, this study showed that pond sizes of 0.2 ha are probably too small for a household to make a living only from coastal aquaculture, considering the economies of scale related to labor inputs, stocking densities, costs and benefits of the currently used system. Further investigations into the current and more intensive production systems (pond size, stocking density, input use, marketing, etc.) are therefore needed to support the coastal aquaculture development planning processes and policies.

Coastal shrimp farming has benefited many farming households. In addition it supported also directly the livelihoods of many, often poor, people that are involved in seed collection, trash fish commercialization, feed production, processing and small scale marketing, via new employment opportunities and incomes. For each 3 aqua-farming households one household is active in services provision (seed collection, processing, marketing) in the sector. Incomes in these aquaculture services sub-sector are often better paid than in the production itself, e.g. incomes from seed supply and in the marketing of the product were on average respectively 30% and 100% higher than from aquaculture. Another advantage of coastal aquaculture is more indirectly for the local economy, due to the increased expenditures of aqua-farming households, the alternatives it offered to fishers to become employed in aquaculture, and the migration (knowledge drain) to the urban centres.

The accessibility of coastal aquaculture production itself for the poorest of the poor is restricted by the decreasing availability of suitable land, the structure of the land markets, lack of technical know-how, lack of investment resources, regulations in favor of those with assets, prejudice of officials towards the capacities of the poor and the competitors in other layers in society. Especially the current land distribution practices under the Land Law increase inequality and limit the access of the poor to aquaculture. Land use contracts in many cases are given only for 5 years and the price of the land rent increases every time when renewal is needed, in this way decreasing the opportunities for the poor to get involved and discouraging sustainable investments in aquaculture. Some government and local level policies are slowly trying to change this situation, but a positive pro-poor policy implementation is lacking. Moreover, in the 3 communes there were some efforts made by local people such as the introduction of group management strategies, in which poor farmers together manage and reap the benefits of a common property pond. Initiatives of this kind show that the poor can benefit a lot from aquaculture, but support and training in pond management, planning and incentives to invest are definitely needed to get more poor actively involved in aquaculture development.

The case study results show that an increase in quantity and quality of aquaculture research and extension to develop further and implement, both in a participatory way, new BMPs in pond management, more intensive production systems, disease prevention measures and product quality management, appear necessary. In addition, the contribution of aquaculture development to the reduction of poverty in coastal areas in Vietnam is definitely significant and visible and the challenge of formulation and implementation of pro-poor policies in the sector, including pro-poor extension services, is taken up by the government and aqua-farmers together. In this respect, advantage should be taken of the present willingness of aqua-farmers to improve their management practices in the process of transformation from (improved) extensive to semi-intensive farming systems.

Case studies on shrimp farming in Ecuador - Stanislous Sonnenholzner, L. Massaut, Jorge Calderon, and C.E. Boyd. A series of case studies on shrimp farming in Ecuador were conducted by CENAIM-ESPOL[2] to identify management practices compatible with sustainable shrimp farming.

Case study on "Use of Wild Post-Larvae" reveals that preference of farm managers in Ecuador for wild post-larvae has decreased in the last five years. Unpredictability of wild seed and year-round availability of hatchery seed are considered the primary reasons for actual preference of stocking hatchery post larvae in grow-out ponds. Year-round production of commercial shrimp hatcheries in Ecuador could supply enough PL to farmers under current stocking densities of 8 to 12 PL/m^2.

[2] Centro Nacional de Acuicultura e Investigaciones Marinas "Edgar Arellano M".

Farm demand for PL is estimated between 38 to 45 billion PL per year. Analysis of historical data from 12 commercial farms stocked either with hatchery or wild post-larvae showed that there is no difference in performance between these two sources of larvae in terms of production in pounds/ha and growth rate (g/week).

A case study on "Shrimp Production in Mangrove" was designed to obtain a scientifically-based opinion as to the suitability of mangrove soil for shrimp farming. Chemical analysis of mangrove and non-mangrove soils in Ecuador showed that mangrove soils are more acidic and have a higher carbon and sulfur concentration. However, production data obtained from several farms revealed no difference in shrimp performance among mangrove soils and other type of soils.

A case study on "Farm Management and Concentrations of Potential Pollutants in Effluents" was conceived to have a better understanding of the composition of shrimp farm effluents in Ecuador. Four farms having different managing practices were sampled at 2-week intervals. Water samples were taken at pond entrance, discharge monk and pumping station. Water quality variables measured were biochemical oxygen demand, total suspended solids, total phosphorus, total nitrogen and chlorophyll a. Major management factors of concerns used to select ponds and farms were stocking density and daily water exchange rate. Based on this information we expect to identify those management procedures useful for improving effluent composition.

A case study on "Water Exchange Practice" was proposed to identify current status of water exchange in shrimp farms and evaluate opinions and expectations of shrimp mangers towards water exchange. Results of the survey conducted on several farm managers reveal that water exchange practice has been reduced in the last five years. Most farmers indicate to have 0 to 2% water exchange per day. One of the reasons that may explain this change in water exchange is the reduction of disease carriers associated with lower exchange rates. Lower stocking densities and energy input since 1999 to manage White Spot Syndrome Disease also contributed to this reduction in water exchange. Historical data on diesel consumption, pumping capacity and pumping frequency is currently being collected in several farms to estimate water exchange practice in the past five years.

A review on "Coastal Wetland Habitats and Shrimp Culture" was envisioned to summarize existing legislation related to mangrove and shrimp culture and to review mangrove status and rehabilitation efforts. Data provided by the Center of Integrated Readings of Natural Resources by Remote Sensors (CLIRSEN) show that mangrove loss due to various economic activities including shrimp farming decreased considerably in the last few years. In fact, no mangrove loss is registered after 1996.

Belize Aquaculture – Robin Macintosh. Belize Aquaculture Limited has developed a highly intensive shrimp culture system that is operated in lined ponds with heavy mechanical aeration and water recirculation. The pilot study of the operation has been in progress for two years and a number of different trials have been conducted in ponds of 0.065 to 1.6 ha in size. Shrimp production has ranged from less than 8,000 kg/ha to more than 20,000 kg/ha per crop. Such high production per unit area without water exchange has several advantages over conventional shrimp culture. These include greater potential for mechanization, reduced use of land and water, fewer logistical problems in pond operations and less effluent. If this system is as efficient as the early data suggest, and if it is suitable for more general adoption by shrimp farmers around the world, it could provide a more environmentally responsible method of shrimp production. The presentation provided an overall description of the farm, and management strategies adopted to improve environmental performance and provide benefits to local people working on the farm.

Shrimp culture in East Africa – Rafael Rafael, J. Clay and Fernando Loforte Ribeiro. The study reviews the status of shrimp culture in selected countries in eastern Africa.

Shrimp culture in South Africa is a new activity; it began 10 years ago in Kwazulu Natal Province, with promising results. However, the prospects for industrial development are restrained due to sub-tropical to temperate climate and limited resources in terms of coastal land and shrimps for aquafarming. Yet, two commercial shrimp farms are in operation in the area, Amatikulu and Mtunzini, and production from intensive culture of *Penaeus indicus* has reached over 100 mt in year 2000. The major setbacks that shrimp culture faced in recent years in South Africa include lack of feed, low nutrition value of local manufactured feed, availability of breeders and overall management of the nursery phase. Despite local interest on shrimp culture, there are no prospects of new farms or further development of current farms managed by Amatikulu Prawns (Pty) Ltd. The sub-optimal conditions have driven the attention and interest of South African companies to invest in shrimp culture in Mozambique.

In Mozambique, the shrimp culture development is in its infancy despite the existence of an excellent environment and vast resources along the coast, which extends for about 2,700 km. Current production is limited to a single industrial farm operating 20 ha and producing around 60 tons per year. Based on culturing of *P. monodon* on semi-intensive system, several factors hampered the development of shrimp culture in Mozambique. Among these are: the centralized economic system, lack of tradition and a long and devastating civil war. In recent years, peace and the foreseen free market orientated Government policies resulted in economic growth and created a momentum for industrial development of shrimp farming. Over short- and medium-term development, shrimp farms and new projects in process of government approval will represent over 39 million USD in private sector investment. They will cover over 900 ha of shrimp farms and produce about 2,500 MT/year.

There is no single commercial shrimp farm in Tanzania. There are two proposals that have been reviewed: the African Fishing Company (the Controversial one) that wanted to farm shrimps in Rufiji delta, and the Prawntan. One extensive shrimp farm is operating in Bagamoyo. The rest are proposals that have not been submitted to the government for review. A national Mariculture Development Guideline was adopted in 2000.

The shrimp culture industry is the most important and developed aquaculture activity in Madagascar. Madagascar is the biggest shrimp farming country in Africa. The largest farm is AQUALMA. Other emerging farms are AQUAMEN, SOMAQUA and AQUAMAS. The shrimp culture industry is based on culturing *P. monodon* in a semi-intensive system. This activity has to follow Fisheries and Aquaculture regulations, be compatible with environmental friendly technology, and the Madagascar shrimp culture code of conduct.

AQUALMA Mahajamba Ferme, Madagasgar – Ken Corpron. Physical description of the farm: total farm land area: 3,800 hectares; total growout surface area: 680 hectares (82 ponds); total nursery area: 62 hectares (52 ponds); total broodstock area: 10 hectares (6 ponds); total supply canal surface area: 220 hectares. Regarding the local mangrove vegetation, the farm is constructed in "tanne" salt flat zone behind mangrove area. Vegetation removed in course of construction was less than 3% of original total. *Avicennia marina* is the main mangrove species represented, and principal species used in reforestation efforts. 100,000 mangrove trees were planted in 1994 along inlet canal and along drainage canals.

Water Supply Characteristics: 4 meter tidal amplitude; total pumping capacity: 72,000 cubic meters per hour; water exchange rate: average 12-15% per day.

Project Parameters; culture species: *Penaeus monodon*. Semi-intensive design with large growout ponds (6-10 ha/pond). Low stocking rates (<8.5-9.5 juveniles/sq./m.) are used, with an average yield per growout pond of 4.4 tones/ha/year. Average annual production of the farm is 3,000 tones/year. Shrimp broodstock source: ~50% captured, 50% cultured. Seasonal environmental variables are temperature (24-32 °C) and salinity (4-36 ppt).

Employment: AQUALAMA operations employ a total of nearly 1,200 full-time staff, drawn 70% from the region of the farm; 500 at processing plant; 550 at farm; 150 in other locations.

Village Community Developments. The nearest village (Besakoa) originally had only 30 inhabitants. There are now 3400. Village development has been carried out, including worker housing, potable water supply, health centre, school, security, fire protection, waste collection & disposal, and revolving credit fund. Incentive programmes are provided according to job function, farm production, technical/mechanical, harvesting, logistics, processing plant and other units.

Global Aquaculture Alliance – G. Chamberlain. Dr George Chamberlain made a presentation on Global Aquaculture Alliance activities on developing management practices for shrimp farming. The consultation was provided with an overview of the history, membership and activities of the GAA. The GAA was founded to address the need to develop acceptable environmental management processes for adoption by the industrial shrimp farmers. The approach is to develop codes of practice, standards, and farm level implementation and audit compliance plans, which can be audited by third parties.

GAA hopes that they will be successful in convincing the market to pay a premium for an 'ecolabelled' product. The premium is expected to provide the incentive for producers to implement the management practices to achieve today's standards and to seek continuous improvement.

The GAA documents were offered as a base standard for consideration by this meeting. It was indicated that the GAA was keen to have feedback on any matters which where unacceptable.

Industrial Shrimp Action Network or ISANet - Mr. D. Barnhizer. Mr. David Barnhizer of the Industrial Shrimp Action Network or ISANet provided a brief introduction about the organization, which is primarily a facilitator organization, particularly on regulatory systems, which now has a membership of about 20 associations around the world. It has supported some activities in Ecuador and Honduras. Law enforcement problems in various countries are hard to address. The case studies currently taking place are important as different organizations can provide a different focus on the same problem. He indicated that this workshop is a good move forward, as 4 or 5 years ago there was no dialogue, whereas at this workshop hopefully there will be an honest exchange of what can be done to make things better.

Discussion points:

The following summarizes the main discussion points arising after the presentations.

The poverty alleviation cases presented were examples from Latin America, and there are as of yet no examples from Asia. It would be appreciated if through this networking, cases of Asian examples can be collected. The case studies and information (grouped and clustered by types) will be posted and regularly updated on Internet by the end of year 2000. With regards to looking at wider impacts and difficulties in measuring changes in poverty over time, it was agreed that the information gathered needs to be further analyzed. Equity in relation to land tenure was brought up as an important issue to be considered.

Clarification was sought in regard to implementation of codes of practice. It was noted that various standards exist (e.g. ISO, HACCP and GAA). The issue of guaranteed standards from other sectors (e.g. hatchery, processing, post-harvest, feed) was raised. Whilst there are some standards, getting inputs or information (some are often confidential) from other sectors, cannot be guaranteed. There are only a few examples of codes (e.g. Thailand shrimp and US catfish) being implemented with operational guidelines. Experience with implementation of some codes (e.g. US catfish) suggests that the less organized the industry or sector is, the greater the benefits of introducing BMPs; whilst with better-organized sectors, the benefits are harder to discern.

In most countries, the weak link in the institutional ability to comply with legislation was identified and discussed. Madagascar was given as an example where environmental issues relating to shrimp farming are being addressed in almost a legal vacuum. The basic regulatory instrument is primarily the Government Lease Agreement and performance based schemes. It was raised that often where legislative frameworks do exist, inadequate financial resources result in an inability to implement or enforce compliance.

The biosecurity of ponds, screening methods (e.g. PCR technology, gross observation, etc.), human health hazards and the implementation of the Asia regional technical guidelines for responsible movement of live aquatic animals in Asia were raised. It was noted that the guidelines have only recently been developed during the Beijing Workshop in China in June 2000, their implementation is still being put in place and so their effectiveness has yet be assessed.

The potential benefits from domestication of shrimp, as a strategy to minimize the risk of disease translocation, was highlighted. It was noted that the domestication of different species of shrimp was at different stages of development. With respect to hatchery health standards and domestication programmes, the meeting was informed of an FAO TCP addressing such issues for implementation in Latin America. The potential for FAO to assist countries with the implementation of codes of practice and technical guidelines was confirmed.

The issue of equity in regard to allocation of farm sites was raised. It was considered that in an ideal situation prawn farmers should (in principle) be treated in the same manner as other users of land in the area. However, that is not the case.

The slow uptake of improved practices by farmers was raised. The current high levels of nitrogen wasted in prawn feeds were highlighted as an important issue. The quality of discharged sediments was discussed.

The implementation of the Thailand Code of Conduct for a wide number of small farms is not clear because of the costs and labor involved. There may be a need to focus on a few important

parameters. The form of monitoring farms once certified under the new Thailand Code of Conduct has yet to be finalized. It is hoped that most farms will be certified. Smaller farms may need to combine treatment facilities in order to be certified. Water quality testing is based on discharge quality as most farms have zero exchange during production. The benefits of certification will be better quality, more marketable prawns.

The technology using plastic liners appears quite successful for *P. vannamei* and it may be possible to use for *P. monodon*, with some variation to the system, particularly the carbon-nitrogen balance. Sludge removed from the ponds is utilized by banana and citrus growers for use in sandy soils at little cost to the farm. Stocking densities of 130-140 pc/m^2 were considered optimal for such a system. It was noted that this type of prawn farming was particularly capital intensive. However, depreciation is less than other types of farming system as a result of the longevity of the infrastructure. The importance of detritus in the feeding of prawns in this system was uncertain, but could account for 23-30% of the total feed requirements.

The discussion revolved around the performance of wild and domesticated broodstock and their Pls, water quality management, diseases and feed. With respect to performance of wild or domesticated broodstock, it was indicated that there was no difference observed in terms of fecundity, hatching rate and survival. Water quality is maintained through water exchange, rarely using aerators, except in emergencies during warmer periods of the year. It was indicated that whilst minimum water exchange may be a good practice from an environmental perspective, in most cases this has been driven by the need to minimize the risk of disease. No mortalities are experienced at low temperatures and salinity levels. Feeds are imported from Taiwan, US and Europe, and average feed conversion rate (FCR) is about 1.85:1.

The final discussion concluded with past and on-going debates about the impact of aquaculture. It was indicated that there has been much work undertaken over the past 30 years. This is not just a recent initiative. To promote good management in various aspects of aquaculture continued effort is required to further improve outcomes.

An Expert Consultation was convened by FAO and the Government of Australia from 4 to 7 December 2000 in Brisbane, Australia. The main objectives of the consultation were to provide a recognized international forum for discussion on major aspects related to the promotion of sustainable shrimp culture practices as well as of related institutional and legal instruments, and to identify or determine avenues, as well as specific benefits and limitations, for the development and implementation of good management practices and good legal and institutional arrangements leading to improvements in shrimp culture management practices at farm and institutional levels. The consultation was attended by 71 participants from 19 countries, including major shrimp producing and consuming nations. The participants included representatives from governments and non-governmental organizations, shrimp producers and associations and intergovernmental agencies. Working papers prepared by FAO were discussed and further developed by participants. The consultation developed and adopted a set of operating principles for sustainable shrimp culture and a set of recommendations including a follow-up process. This document gives a detailed description of the preparation, conduct and recommended follow-up of the consultation.

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